AVIATION WEEK

50 CENTS

The world's most accurate gyros

HONEYWELL'S HIGs

HONEYWELL'S family of floated gyros is the key to precision control unattainable with any other line of gyros.

Honeywell Hermetic Integrating Gyros, (called HIGs for short) can be used as rate gyros, platform stabilization gyros, directional gyros, free or precessible gyros. They're excellent for missile guidance, fire control systems, radar stabilization, inertial guidance and many other precision jobs.

These Honeywell HIGs are small, rugged and the world's most sensitive. One model can detect a turning rate as slow as one revolution in 3 years. As members of a family they have similar characteristics—yet each member has certain special qualifications.

For instance: The HIG-4 offers small size and weight (4 in. tall, 1.5 lbs.) and high performance for fire control. The HIG-5 is light (3.0 lbs.) but taller (6 in.) and gives high accuracy for fire control and guidance. The HIG-6 provides the very greatest sensitivity and accuracy for platform stabilization and inertial guidance systems—is 6 inches tall and weighs 4.5 pounds.

In addition to the HIGs, Honeywell manufactures a complete line of non-floated rate, vertical and cageable vertical gyros. For detailed information on the HIGs or any of Honeywell's gyros write, on your business letterhead, to Dept. AW-1-17 at the address given below.

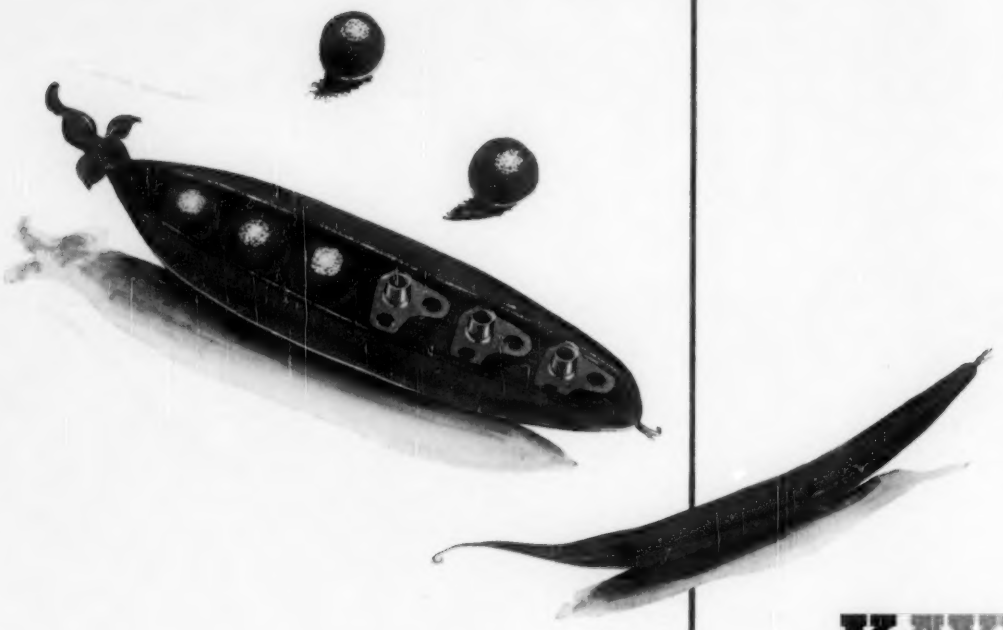
MINNEAPOLIS
Honeywell
Aeronautical Division

2600 Ridgway Road, Minneapolis 13, Minn.

HONEYWELL

E 3 POWER
UNIVERSITY MICROFILM INC
313 N 1ST ST
ANN ARBOR MICH

*The Greeks had a word for it!



KAYLOCK
TRADE MARK

MINIATURES
ALL METAL SELF-LOCKING NUTS

for aircraft, guided missiles and electronics

LIGHTEST — STRONGEST — SMALLEST

Specify Kaylock "MK" series —

only FRACTION OF SIZE

uses less than 1/2 the space of comparable standard anchor nuts

only FRACTION OF WEIGHT

1/5 the weight of comparable standard anchor nuts

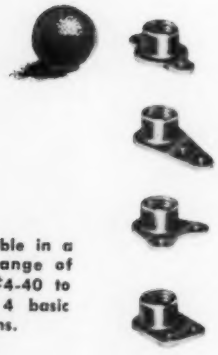
A positive, simple design principle provides the utmost in locking dependability.

Kaylock nuts are precision products, produced in full conformance with air force-navy specifications AN-N-5 and AN-N-10.

Check these features:

- **Lightest Weight**
- **Highest Axial Strength**
- **Lowest Height**
- **Most Constant Locking Torque**
- **"Infinite" Reusability**
- **Impossible to damage by cross-threading**
- **Only one part required for both 250° F. and 550° F.**
- **No fungus nutrient**
- **No low temperature limitations**

*minuscule



New available in a complete range of sizes from #4-40 to 5/16-24 in 4 basic configurations.

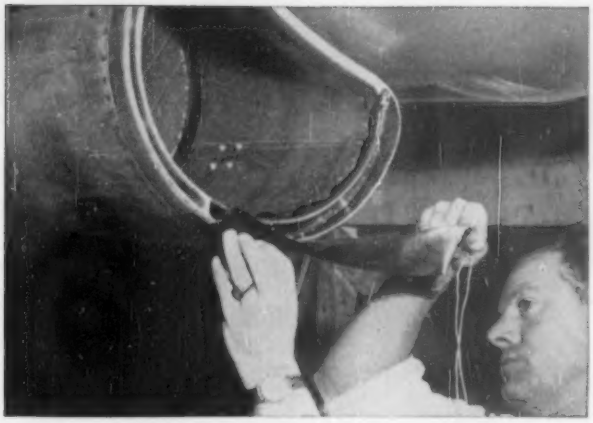
THE KAYNAR COMPANY · KAYLOCK DIVISION · BOX 2001, TERMINAL ANNEX · LOS ANGELES 54, CALIFORNIA

Canada Distr.: Abercorn Aero Limited, Montreal

It's Peebling

RESEARCH KEEPS **B.F.Goodrich** FIRST IN RUBBER

How to keep planes from coming down with the cold

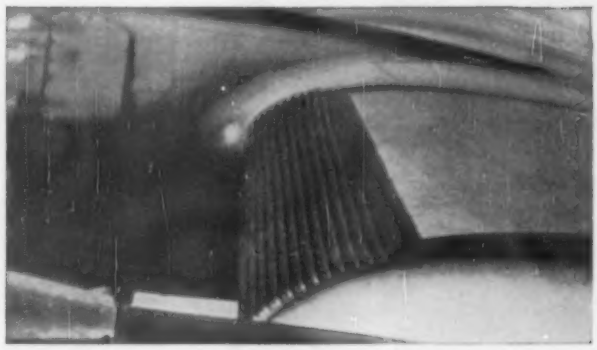


KEEPS ICE FROM CHOKING A PLANE'S THROAT

Ice forming in the narrow "throat" of an engine intake could soon choke off vital air supply. B. F. Goodrich electrically heated rubber—rubber with resistance wires in it like a heating pad—prevents ice from forming. Its flexibility lets it fit skin-tight around the intake's bulges, curves and corners. BFG heated rubber also gives cold weather protection on propeller blades, spinner domes, hydraulic lines, many other parts.

EGG BEATER WHIPS ICE

The weight of ice forming on rotor blades used to ground helicopters in cold weather. The problem was to design an anti-icing system that wouldn't add as much weight as the ice. B. F. Goodrich engineers developed a set of specially shaped heated rubber boots that minimized weight and bulk. 30-day tests in freezing rain and snow, down to −14°F, proved their worth. The biggest single obstacle to all-weather helicopter operation was removed.



MAKES ICE REMOVING A SNAP

This B. F. Goodrich De-Icer has rubber tubes that inflate to crack ice off wing leading edges. B. F. Goodrich De-Icers have been giving planes ice protection since 1930. Latest type De-Icers snap off ice faster by inflating quicker with almost three times the pressure of earlier models. They last longer, too, because they're simply cemented to the wing without stretching or fixed tension.

RUBBER BOOTS HELP BUSINESSMEN HURRY

"We can count on B. F. Goodrich De-Icers to keep wings of our plane ice-free," say flight personnel of the Hoover Company. "They enable us to make trips we otherwise couldn't make." Practically every executive plane of twin-engine size or larger has De-Icer plumbing already built-in, making the cost of De-Icer installation low-cost insurance.

For 25 years, B. F. Goodrich engineers have been solving aircraft icing problems of all kinds. Why not let them put this background of experience to work for you? Write *The B. F. Goodrich Company, Aeronautical Sales, Akron, Ohio.*

B.F.Goodrich
FIRST IN RUBBER

It's Roebling

LOCK-CLAD

Aircord on the

B-52's

HIGHER AE VALUES ...a coefficient of expansion approximating that of the dural airframe... a smooth cylindrical surface...maximum dependability...these are the features that dictated the choice of Roebling Lock-Clad Aircord for the B-52's.

Lock-Clad Aircord is preformed aircraft cable with an aluminum alloy tube swaged around it. The cable has the strength and safety inherent in a multiple structure, and the tubing reduces the undesirable stretch caused by load application. Important, too, Lock-Clad's smooth, unbroken surface fits perfectly through pressurized cabin stuffing boxes.

Contact our Engineering Department for information and suggestions on complete, ready-to-install Lock-Clad Control Cable Assemblies. John A. Roebling's Sons Corporation, Trenton 2, New Jersey.

ROEBLING

SUBSIDIARY OF THE COLORADO FUEL AND IRON CORPORATION

Aviation Week

JANUARY 10, 1955 VOL. 62, NO. 2

Editorial Offices
New York 36—330 W. 42nd St., Phone LOngacre 4-3000 (Night LO 4-3035)
Washington 4, D. C.—National Press Bldg., Phone NAtional 8-3414
Los Angeles 17—1111 Wilshire Blvd., Phone MAdison 6-4323

Table of Contents on Page 8

54,239 copies of this issue printed

Robert W. Martin, Jr. ..... *Publisher*

Robert H. Wood ..... *Editor*

Robert B. Hotz, *Executive Editor*

Albert W. Bentz ..... **News Editor**
David A. Anderton ..... **Engineering**
Irving Stone ..... **Technical**
G. L. Christian ..... **Equipment, Maintenance**
Katherine Johnsen ..... **Congress**
Philip Klass ..... **Avionics**
Claude O. Witze ..... **Military**
Frank Shea, Jr. ..... **Transport**
Craig Lewis ..... **Transport**

Erwin J. Bulban ..... **Special Assignments**
William J. Coughlin ..... **West Coast**
Bernie Lang ..... **West Coast Assistant**
Henry Lefer ..... **News Desk**
Gordon C. Conley ..... **News Desk**
G. J. McAllister ..... **Washington News Desk**
Lawrence J. Herb ..... **Art Editor**
Victoria Giaculli ..... **Editorial Makeup**
Frank Alberti ..... **Printing & Production**

DOMESTIC NEWS BUREAUS

Atlanta 3 ..... 801 Rhodes-Haverty Bldg.
Chicago 11 ..... 520 No. Michigan Ave.
Cleveland 15 ..... 1510 Hanna Bldg.
Detroit 26 ..... 856 Penobscot Bldg.
Houston 25 ..... 1303 Prudential Bldg.
Los Angeles 17 ..... 1111 Wilshire Blvd.
San Francisco 4 ..... 68 Post St.
Washington 4 ..... 1189 National Press Bldg.

FOREIGN NEWS SERVICE

Editor ..... John Wilhelm
London ..... Edward W. S. Hull
Paris ..... John O. Coppock
Tokyo ..... Dan Kurzman
Bonn ..... Gerald W. Schroder
Mexico City ..... John H. Kearney
Sao Paulo ..... Lionel J. Holmes

Aviation Week is served by PRESS ASSOCIATION, INC., a subsidiary of Associated Press.

Research and Marketing: Irina Nelidow, Mary Whitney Fenton, Jeanne Rabstejnek, and Mildred Raba.

J. G. Johnson ..... *Business Manager*

T. B. Olsen, **Promotion Manager** W. V. Cockren, **Production Manager**

Sales Representatives: J. C. Anthony, **New York**; H. P. Johnson, **Cleveland**; D. T. Brennan and J. S. Costello, **Chicago** and **St. Louis**; E. P. Blanchard, Jr., **Boston**; James Cash, **Dallas**; William D. Lanier, Jr., **Atlanta**; T. Evans Wyckoff, **San Francisco**; C. F. McReynolds and Gordon Jones, **Los Angeles**; W. S. Hessey, **Philadelphia**; C. A. Ransdell, **Detroit**. Other sales offices in **Pittsburgh**, **London**.

AVIATION WEEK • JANUARY 10, 1955 • Vol. 62, No. 2
Member ABP and ABC

Published weekly by McGraw-Hill Publishing Company, James H. McGraw (1860-1948), Founder. **Publication Office: 99-129 North Broadway, Albany 1, N. Y.**

Executive, Editorial and Advertising Offices: McGraw-Hill Building, 330 W. 42nd St., New York 36, N.Y. Donald C. McGraw, President; Willard Chevalier, Executive Vice-President; Joseph A. Gerardi, Vice-President and Treasurer; John J. Cooke, Secretary; Paul Montgomery, Executive Vice-President, Publications Division; Ralph B. Smith, Vice-President and Editorial Director; Nelson Bond, Vice-President and Director of Advertising; J. E. Blackburn, Jr., Vice-President and Director of Circulation.

Subscriptions: Address correspondence to AVIATION WEEK—Subscription Service, 99-129 North Broadway, Albany, 1, N. Y. or 330 W. 42nd St., New York 36, N. Y. Allow 10 days for change of address.

Subscriptions are solicited only from persons who have a commercial or professional interest in aviation. Position and company connection must be indicated on subscription orders.

Single copies 50¢. Subscription rates—United States and possessions, $6 a year; $9 for two years; $12 for three years. Canada $8 a year; $12 for two years; $16 for three years, payable in Canadian currency at par. Other Western Hemisphere and the Philippines $10 a year; $16 for two years; $20 for three years. All other countries $20 a year; $30 for two years; $40 for three years. Entered as second-class matter July 16, 1947, at the Post Office at Albany, N. Y., under Act of Mar. 3, 1879. Printed in U. S. A.

Copyright 1955 by McGraw-Hill Publishing Co., Inc.—All Rights Reserved. Cable Address: "McGraw-Hill New York." Publications combined with AVIATION WEEK are AVIATION, AVIATION NEWS, AIR TRANSPORT, AERONAUTICAL ENGINEERING and AIRCRAFT JOURNAL. All rights to these names are reserved by McGraw-Hill Publishing Co.

New hand-size cooling turbine weighs less than 2 pounds!

You've read about the new deadly miniature combat jets like the Douglas A4D. Here, even the rivets had to be scaled down in size to meet the critical weight problem.

Existing cooling components could not meet the exacting specifications. AiResearch engineers, designers of the first midget cooling turbine (right) for America's early jets, solved the problem by designing the refrigeration turbine shown on the left.

This new turbine weighs less than 2 lbs. It produces 15½ h.p. and has the cooling capacity of 2300 lbs. of ice per hour. *Its weight is half the original unit, yet it has twice the cooling capacity.* Operating on the A4D and the Grumman F9F9, this cooling turbine has already demonstrated its high efficiency and extremely low oil consumption.

In the field of air turbine refrigeration, AiResearch has devoted over 900,000 research and development hours. Nearly 50,000 units have been produced. Still the search goes on relentlessly for ways to achieve ever more efficient performance from smaller units of less weight.

Qualified scientists, engineers and craftsmen are needed now. Write for information.

THE GARRETT CORPORATION

AiResearch Manufacturing Divisions

Los Angeles 45, California • Phoenix, Arizona

Designers and manufacturers of aircraft components: REFRIGERATION SYSTEMS • PNEUMATIC VALVES AND CONTROLS • TEMPERATURE CONTROLS CABIN AIR COMPRESSORS • TURBINE MOTORS • GAS TURBINE ENGINES • CABIN PRESSURE CONTROLS • HEAT TRANSFER EQUIPMENT • ELECTRO-MECHANICAL EQUIPMENT • ELECTRONIC COMPUTERS AND CONTROLS

the new Beechcraft Twin-Bonanza

Here's great news for America's business executives – a six-passenger, twin-engine aircraft that *flies farther* and *flies faster* than any other plane in the six-place field. And it's a *Beechcraft!* The new Beechcraft Model C50 Twin-Bonanza offers busy executives these outstanding – and unmatched – features:

GREATER Power – Two dependable Lycoming power plants, each rated at a full 275 horsepower. This means better short-field and single-engine performance – widens your scope of operations.

GREATER Speed – At only 66.6 per cent of power, and at full gross load, this new Beechcraft cruises at 200 mph. Top speed is 210 mph.

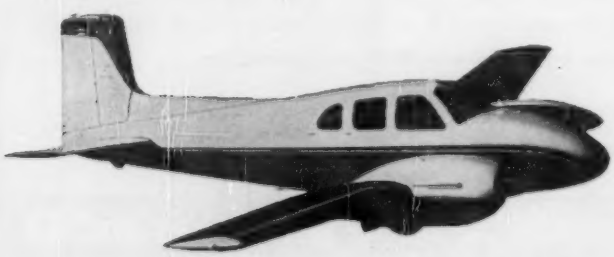
GREATER Range – Chicago to Houston, San Francisco to Denver, Detroit to New Orleans can be nonstop trips in the new Twin-Bonanza with a range up to 1100 miles.

GREATER Comfort – Top-quality materials provide the ultimate in styling in the big, roomy, six-place cabin *now more quiet than ever!* Plus thermostatically controlled heating for in-flight comfort, and a ventilating system for comfort on the ground.

GREATER Ruggedness – The Twin-Bonanza is designed to an 8G flight load safety factor, far in excess of the 5.7G ultimate factor required by Civil Air Regulations for planes of this category. Sixty-five per cent of the weight of the plane is located below and forward of the passengers – a feature made possible by the smart, modern, low-wing design.

BACKED by Experience – Hundreds of Beechcrafts of this basic design are in service throughout the world for business executives and the military services. From the experience of millions of in-flight miles flown by earlier Twin-Bonanzas, Beechcraft has incorporated hundreds of design, equipment, and style changes in this new model. In addition, the Twin-Bonanza incorporates all of the traditional Beechcraft know-how and quality craftsmanship. The Beechcraft Model C50 Twin-Bonanza is proved by the past, designed for the future.

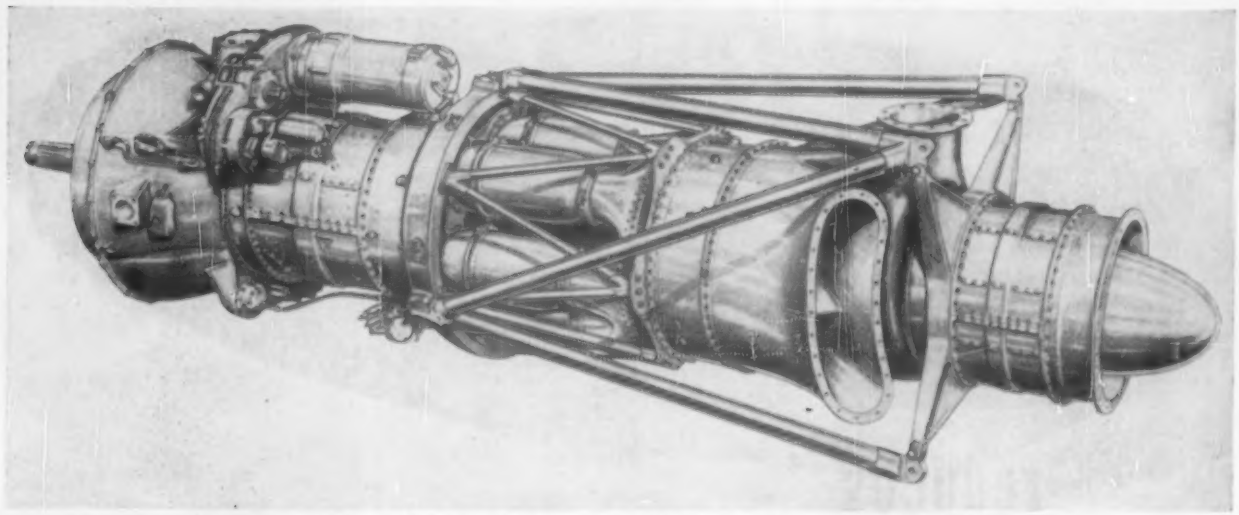
See your Beechcraft distributor, or write Beech Aircraft Corporation, Wichita, Kansas, for information on how this newest addition to "The Air Fleet of American Business" can serve you and your business.



Beechcraft

BEECHCRAFTS ARE THE AIR FLEET OF AMERICAN BUSINESS

NEWS DIGEST



Napier Unveils Turbine for Fairey Compound Copter

To meet requirements of the upcoming Fairey Rotodyne 40-passenger compound helicopter, D. Napier & Son has developed this version of its Eland turboprop engine to serve both vertical and highspeed forward flight needs. This model currently is rated at 3,000 ehp. It features an auxiliary compressor (far right) mounted coaxially at the rear of the engine, supported by the tubular structure which also acts as the mounting for the main engine. A hydraulic coupling, between the turbine and the auxiliary compressor, permits power to be taken through the propeller for forward flight, or from the auxiliary compressor in the form of compressed air to the main rotor blades. Thus, for takeoff and landing, power from the auxiliary compressor would drive the main rotor; for highspeed forward flight, the auxiliary compressor would be "declutched" and the basic engine would turn its propeller.

Domestic

Lockheed's XFV-1 VTO was scheduled to make its initial vertical takeoff last week at Palmdale, Calif. XFV-1 was to retain landing gear fitted for earlier horizontal take off, landing flights. Plane was to make first vertical flight untethered; unlike Convair VTO, which initially took off in a hangar using precautionary cables, made free flights later.

Piasecki Helicopter Corp.'s first HUP-4, new version of the HUP-2 with a Wright R1300 engine, has made its first flight. Company will modify a second helicopter for Navy tests.

Dianna Bixby, 32, well known aviatrix who made an unsuccessful attempt to fly around the world in 1950, was killed last week when her converted A-20 bomber crashed into the Gulf of California on a cargo flight from Long Beach. Early reports indicate she ran out of fuel. Mrs. Bixby and her husband were operators of Bixby Airborne Products.

Air Force has installed its first operational transmissometer, an electronic aid for determining visibility, at Andrews AFB, Md., headquarters of Military Air Transport Service. Approximately 20 other bases are scheduled to receive the weather aid.

Fairchild Aircraft Division, Hagerstown, Md., delivered its 1,000th C-119 Flying Boxcar to USAF Dec. 22. Other aircraft industry marks: McDonnell Aircraft Corp., St. Louis, Mo., delivered its 1,000th plane, an F3H-1N Demon jet fighter to the Navy on Dec. 29, and Piper Aircraft Corp., Lock Haven, Pa., delivered its 100th twin-engine Apache business plane.

Jet thrust spoiler "brakes" have been designed for possible future application on Boeing B-47 Stratojet bombers by General Electric Co.'s Aircraft Gas Turbine Division, Cincinnati, Ohio. GE also has developed a thrust reverser, similar in principle to the spoiler, providing up to 35% reverse thrust on the J47's dry military rating.

Lockheed Aircraft Corp. has been awarded a $38,688,973 Navy contract for a number of early warning Super Constellation radar pickets.

Utility and executive plane shipments by seven manufacturers during November totaled 260, including 232 four-places or more, and 28 one-and two-place aircraft. Total dollar value: $3,717,000. Comparable shipments in October totaled 155 planes valued at $3,663,000.

Mrs. Oscar A. Solbrig, 85, one of the first women aircraft mechanics and among the few women to qualify as an Early Bird, died Dec. 29 at Davenport, Iowa.

Western Air Lines has ordered five additional Douglas DC-6Bs, with delivery scheduled for 1956. Airline expects that it will show substantially higher earnings over 1953's $1,184,864.

USAF will spend $84,624,326 to stockpile machine tools for the aircraft industry. Long leadtime items will be chosen with emphasis on tools that can be adapted to changing factory methods. Air Materiel Command will negotiate contracts.

Financial

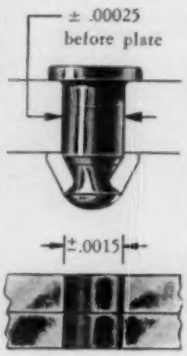
Northwest Orient Airlines predicts its revenues for 1955 will climb to an all-time high of approximately $70 million. Revenues for 1954 totaled a record $63,023,000, exceeding by more than $1 million the previous mark of $61,834,000 set in 1953. Net operating income for the first 11 months of 1954: $1,959,375, compared with $1,349,294 for the same period of 1953.

International

Fokker Industria Aeronautics, S. A. has completed its first trainer for the Brazilian air force at Galleao Airport, Rio de Janeiro.

Reversing the usual procedure of inserting a semi-close tolerance fastener into a close tolerance hole—

HS51P-52P series HI-SHEAR rivet with a close tolerance shank, fits into a semi-close tolerance hole, pilot and core drilled.



This easier made hole

reduces installation costs

Additional savings are realized in less drilling skill needed, equipment and inspection.

The head shaving operation, to achieve surface smoothness, is eliminated by installing this close tolerance head style HI-SHEAR into a properly prepared countersunk or dimpled hole.

160,000-180,000 psi heat treat—lead chamfer to aid interference fit—cadmium plated after grind to prevent corrosion.

Write for the HI-SHEAR Standards Manual

U.S. and Foreign Patents—Trademark Registered

THE hi-shear RIVET TOOL CO.
8924 BELLANCA AVENUE
LOS ANGELES, CALIF.

The Aviation Week

January 10, 1955

Headline News

UAL to Spend $50 Million for DC-8s .. 13
Army Aviation Buying Fight Looms .. 14
Design Changes Make F-102 Supersonic 15
P6M Role: Jet Seaplane Striking Force 16
MATS in '54: 10,000 Oversea Trips .. 18
U. S. Sets Aircraft Export, Import Fees 18
U. S. to Try Dutch Approach Lights .. 21

Aeronautical Engineering

Bell Builds Rocket Knowhow 28

Production

Hurdles to Titanium Fastener Use 37

Avionics

Sperry System Eases Pilot's Job 58

Aviation Safety

Parts Catalog Not for Maintenance ... 76

Air Transport

Mexico Shifts Policy, Plans N. Y. Route 91
Nonsked Halts Nonstop Service 91
Civil Reserve Air Fleet Quotas 92
TWA Completes Financing Plan 92
National Airport Has Biggest Year 92
Seaboard Sees Atlantic Gains in '55 ... 92
Would Expand Western Services 93
New Canadian Rule: Mile from Clouds 94
Patterson Supports Railroad Subsidies 94
Dallas Wins Support on Airport 96

Departments

News Digest 7
Picture Page 9
Who's Where 11, 57
Industry Observer 11
Washington Roundup 12
What's New 25
Thrust & Drag 31
Production Briefing 47
Navy Contracts 48
USAF Contracts 50
ARDC Contracts 52
Filter Center 64
Overseas Spotlight 67
New Aviation Products 68
Also on the Market 75
Shortlines 97
News Sidelights 104
Aviation Calendar 104
Letters 105

Picture Credits

7—McGraw-Hill World News; 9—Convair; 13—Lawrence Herb; 15—Convair; 16, 17—Martin Aircraft; 28, 29—Bell Aircraft Corp; 30—McDonnell Aircraft Corp.; Boeing Airplane Co.

RELIABLE AND STABLE PERFORMANCE

A.C. servo and computer components

Let us quote on your detailed requirements.

American Electronic Mfg., Inc.

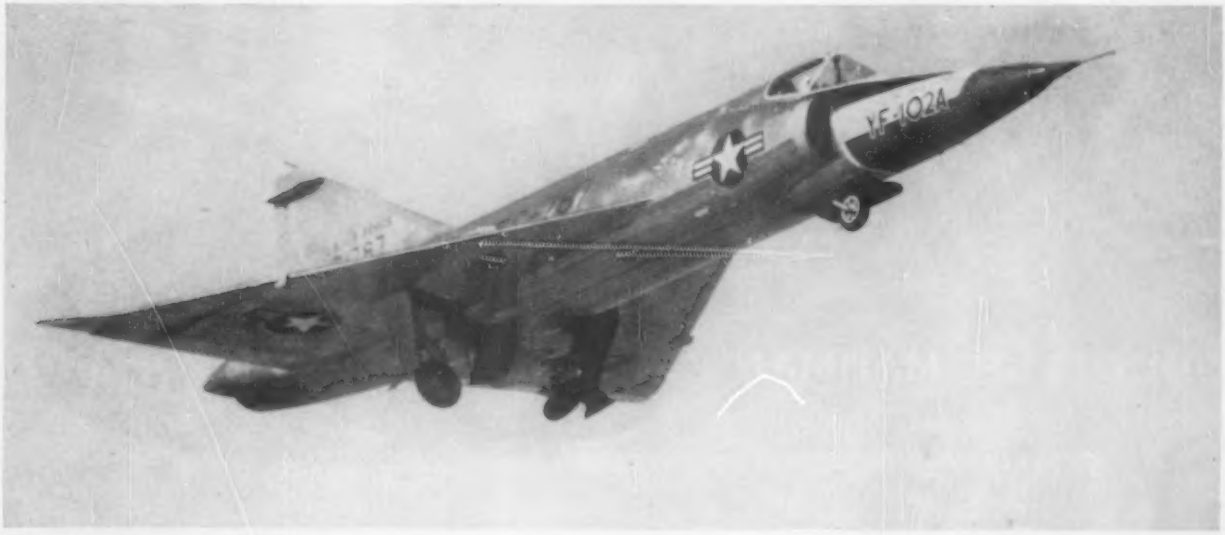
INSTRUMENT DIVISION OF AMERICAN ELECTRONICS INC.

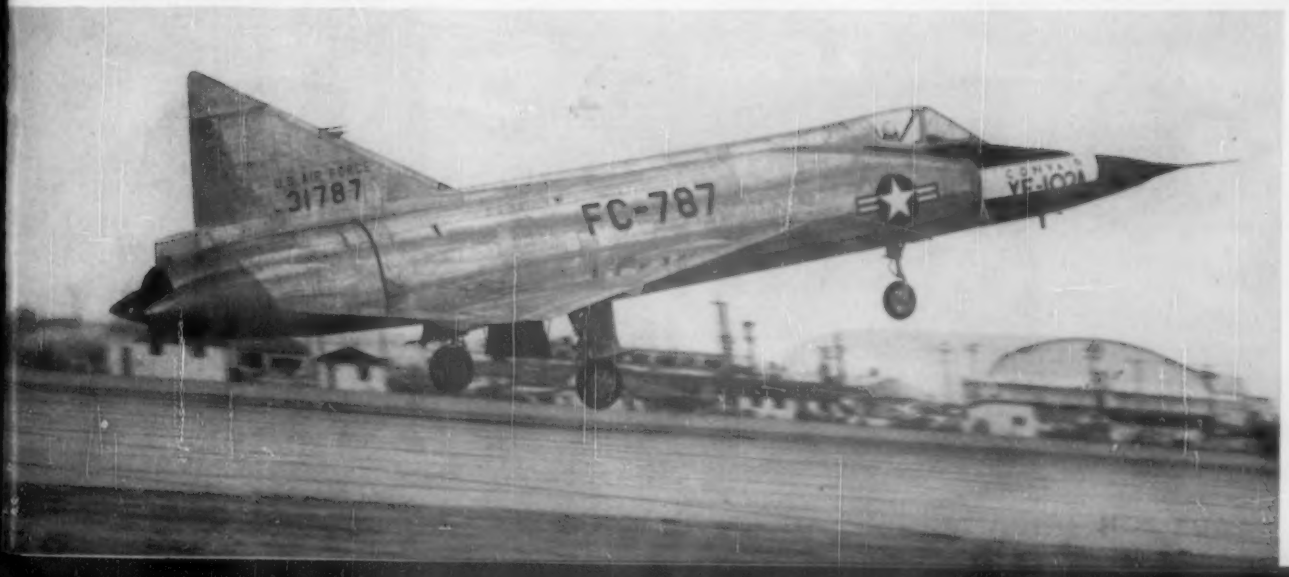
9503 W. JEFFERSON BLVD. • CULVER CITY, CALIF.
Telephone: TExas 0-5581 • VErmont 8-6402

Application Engineering Offices in Principal Cities

New Convair YF-102A Gets Supersonic Workout

LATEST VERSION of Convair Division's delta-wing interceptor is the YF-102A, shown taking off from Edwards AFB, Calif., piloted by Richard Johnson. Numerous design changes, such as its new nose, revised cockpit canopy and addition of tail blisters to aid its supersonic performance in level flight are explained in an article with additional pictures on p. 15.





stars in their orbit . . .*

PRODUCTS OF **MARMAN** RESEARCH AND DEVELOPMENT

Marman clamps, straps, couplings and certain closely related products stand out as precision stars of the Aircraft Industry . . . the result of specialization and of close cooperation at the planning stage between industry development teams and Marman engineers. Marman's highly developed production facilities and experienced personnel deliver the finished product as ordered year in and year out.

You will find it good economy to specify Marman clamps, straps, and couplings, off the shelf, or specially engineered for your project.

**Examples of the many standard and specially designed Marman products . . . from top left: channel band coupling, J-11 joint, filter, high-temp venturi, valve, adjustable band clamp, flexible coupling.*

MARMAN

MARMAN PRODUCTS COMPANY, Inc. 11214 EXPOSITION BLVD., LOS ANGELES, CALIF.

Marman products are manufactured under various U. S. and foreign patents and other patents pending

WHO'S WHERE

In the Front Office

R. A. Stranahan, Jr., is new president of Champion Spark Plug Co., Toledo, succeeding his father, **R. A. Stranahan, Sr.,** who becomes chairman of the board. Other changes in the executive realignment: **F. D. Stranahan,** co-chairman of the board; **Howard B. Speyer,** vice president-treasurer; **R. K. Christie,** vice president-research and engineering; **O. C. Leighty,** vice president-sales; **Harry Davis,** equipment sales manager. New board member: **Dr. J. S. Owens,** general manager of the Ceramic Division, succeeding division vice president **F. H. Riddle,** who has retired.

H. L. Schroeder, past president of the National Association of State Aviation Officials, ended 12 years as Minnesota state commissioner of aeronautics last week to specialize in aeronautical law in Minnesota. He was succeeded by **Mitchel Perrizo, Ja.**

J. S. Parker has been named general manager of General Electric Co.'s Aircraft Gas Turbine Division, Cincinnati, filling the vacancy created recently by appointment of vice president **C. W. LaPierre** as group executive of the company's Atomic Energy and Defense Products Group. Parker previously was manager of the small aircraft engine department.

Herbert Kunzel has moved up to executive vice president of Solar Aircraft Co., the first to hold that position since the San Diego firm was founded in 1927.

Everett M. Patterson has been promoted by Avien, Inc., Woodside, N. Y., to vice president-engineering and manufacturing. Also promoted to vice president: **William O. Boschen,** sales; **H. Hawley Myers,** treasurer.

Frank C. Nash, former Assistant Secretary of Defense, has been elected to the board of General Dynamics Corp., New York. Other new directors: **Robert B. Watts,** vice president-general counsel of the firm's Convair Division; **Allen D. Marshal,** vice president-management and secretary of the corporation.

Honors and Elections

Dr. William H. Huggins, professor of electrical engineering at Johns Hopkins University, has won USAF's Decoration for Exceptional Civilian Service for working out new approaches in avionics during his association with the Air Force Cambridge Research Center (1946-52).

Changes

Thomas R. Nolan is director of Northwest Orient Airlines' new Air Freight Sales Division, and **Fred R. Erickson** has become director of the recently created Air Express Division.

R. H. Lundberg has moved up in Chance Vought Aircraft, Inc., Dallas, to chief industrial engineer. Also promoted: **Charles H. Coleman,** to assistant chief of flight test.

Vernon A. Johnson has become Washington, D. C., manager for Lockheed Aircraft Corp.

(Continued on p. 57)

INDUSTRY OBSERVER

► Radically new picture tube, developed by Willys Motors' Electronics Division, which opens the way to displaying radar and blind-landing information on airplane windshields, eventually in color, is expected to be shown on the West Coast this week. Existence of the new tube was first revealed in AVIATION WEEK Sept. 20, 1954, (p. 10). Tube was developed under the supervision of William R. Aiken and will have many other military applications.

► **Vickers Supermarine Swift is still being evaluated for service by the Royal Air Force. Swifts were cleared for service early last year and one squadron received several Mk. 1 and Mk. 2 versions. The aircraft have been grounded twice and no other versions have been issued for squadron service.**

► Republic F-84F Thunderstreaks in service have a Mach limitation of 1.175. Mach .9 to .94 is permissible with external tanks. Ferry range is more than 2,000 mi.

► **U. S. Navy is experimenting with a wingtip radar installation on a McDonnell F2H-3 Banshee. Scanner is mounted in a tiptank-type pod.**

► Grumman is investigating the use of the Lear 5-in. gyro horizon as a replacement for the 3-in. model now used because of the excellent readability of the larger instrument, an important factor in highspeed aircraft. McDonnell has ordered Lear vertical gyro indicators for the F3H (AVIATION WEEK Dec. 27, 1954, p. 50).

► **Napier turboprop Eland engine has completed 150-hr. type test at its initial power rating of 3,000 ehp. Company reports engine is on schedule and the 150-hr. test was completed satisfactorily on first attempt. Eland was first test flown last August.**

► Fairey Gannet anti-submarine aircraft has completed a comprehensive range of hot weather trials to test the aircraft's Double Mamba engine under full Mediterranean conditions. Service flying and delivery of super-priority production aircraft have been resumed following engine modifications. Plane was grounded early in October because of engine defect.

► **Breguet 960 Vultur turboprop-plus-jet prototype will have its 5,000-lb.-thrust tail turbojet removed as part of a modification program to make the plane a prototype for a new, lighter French navy anti-submarine plane, the Breguet 1050. Another Breguet 960 is being altered to include a boundary layer control system which will provide greater lift and lower landing speed.**

► Marcel Dassault M.D. 450 Ouragon jet fighter, fitted with a "diabolo" landing gear and parabrake, has successfully landed on an unprepared field in 820 ft.-1,143 ft., distances varying according to the plane's load. Takeoffs were made in 1,868 ft. to 2,525 ft.

► **Marcel Dassault M.D. 453 two-place night-fighter version of the Mystere has been modified as a flying test-bed in order to carry out ejection seat experiments.**

► Three French SIPA 300 light trainers, powered by Turbomeca Palas jets, have started their initial flight tests. One of the planes is scheduled to go to Argentina.

► **Grumman F9F-8s soon will be equipped with angle of attack indicators on a production basis. Instruments are manufactured by Specialties, Inc., Syosett, N. Y.**

► Air Navigation Development Board is scheduled to meet this week to make a decision in the civil-military dispute over a "common system" of air navigation involving the civil DME and military Tacan systems. ANDB will consider the recommendations that were made recently by its Vortac committee.

Washington Roundup

Pentagon and Congress

Jittery Defense Department officials are tightening Pentagon lines to face an assault of congressional investigations. Word has gone out to military spokesmen reminding them that the Office of Assistant Defense Secretary (Legislative and Public Affairs) Fred A. Seaton must clear information prepared for Capitol Hill. This goes for data submitted to House or Senate probes as well as the answers to queries from individual congressmen.

Avowed purpose of the order is to insure that when information is provided, it is complete information, not confined to what one officer or one service knows about a particular subject. Other, and unannounced, factors: Defense Department must guard against sniping among the services.

It is generally believed in Washington that the Democrats, now in the congressional driver's seat and a good position to embarrass the Administration, will show restraint. They are expected to aim their shots carefully at top Administration officials, avoiding the lead-pipe techniques that brought inquiries into some disrepute during the past two years.

Airline Mergers

Dispute over whether and to what extent Eastern Air Lines has control of Colonial Air Lines, which has been running ever since the White House turned down a proposed Eastern-Colonial merger, is a step nearer decision. Hearings closed with findings that all but about 5,000 of the 110,524 shares originally found to be under EAL influence have been disposed of.

Last big sale was 15,700 shares by Allen and Company late last month, because Colonial stock became less attractive under terms of the latest Eastern offer of one EAL share for two Colonial shares. National refuses to make a new offer until the control question is cleared up.

Another carrier got a nudge toward merger when CAB ordered suspension and investigation of proposed fare increases by Northeast Airlines. The Board observes that even if the increases were granted, they wouldn't solve Northeast's financial problems. CAB says: "It would appear that any effective solution of the problem lies in the direction of pursuing sound merger possibilities or similar route adjustments rather than by raising its charges to the traveling public."

Manpower Investigation

White House denial that it has received a letter from Army Chief of Staff Gen. Matthew B. Ridgway protesting proposed Army personnel cuts is due to the fact that the paper is delayed in Pentagon channels. Ridgway has written to the President, voicing his deep concern over proposed cuts in the ground forces. The paper is being routed to President Eisenhower through Army Secretary Robert Stevens and Defense Secretary Charles E. Wilson.

Main rub: It is generally accepted that the President made the decision himself, basing his action on what he considered to be sound information from military advisors. Ridgway's disagreement with his Commander-in-Chief, already no secret, may get a congressional airing. Sen. Richard Russell, new chairman of the Senate Armed Services Committee, has announced that his group promptly will hold closed-door hearings on the planned Army cutback. House Armed Services Committee is expected to make a similar investigation.

Negotiation on Panagra

Justice Department's anti-trust case against Pan American World Airways and W. R. Grace and Co., seeking to divest them from control of Panagra, may be negotiated, averting the necessity for lengthy court litigation. PAA is voluntarily submitting records and files to the department.

Assistant Attorney General Stanley N. Barnes points to the average requirement of two and a half years for settlement, compared with five years for court cases. Replying to the Justice suit, PAA declared Panagra has been an integral part of its system for 25 years "with the full knowledge and approval of the government and to the great benefit of the public" (AVIATION WEEK May 3, 1954, p. 76).

Air Force ROTC Plans

USAF is considering plans to spur its pilot recruitment program and to place ROTC engineering graduates in attractive assignments.

College students in Air Force ROTC units may be given an opportunity to take flying lessons from private contract operators which will lead to a private pilot's license. USAF believes this will increase the student's interest in flying and serve as a screening point for individuals who would wash out of regular Air Force flying training schools.

ROTC graduates with engineering degrees may be granted opportunities to serve their tours with the National Advisory Committee for Aeronautics where their skills can best be utilized. Air Force claims this will help alleviate the shortage of professional engineers for top-priority NACA projects and give the young engineer valuable experience in future civilan work.

CAA Changes

Recommendations made in a $104,000 management study of Civil Aeronautics Administration are gradually being implemented where feasible, according to Commerce Department's Assistant Secretary for Administration, James Worthy. The study, completed several months ago, will not be made public. It was the target of a vigorous attack last year by the late Sen. Pat McCarran who called it "a complete waste of funds."

Route Decision Delays

There has been considerable consternation in airline circles over the fact that Jan. 1 has come and gone without the long-anticipated decisions on route cases from the White House. It has been expected that President Eisenhower would clear his desk as far as air transport cases were concerned by year's end.

This, coupled with the fact that Civil Aeronautics Board found itself operating last week with only four members as a result of the failure to reappoint Oswald Ryan by his Dec. 31 termination date or to name a successor, had the airline route picture in a complete state of flux.

—Washington staff

AVIATION WEEK VOL. 62, NO. 2
JANUARY 10, 1955

Patterson Bombshell . . .

United to Spend $50 Million for DC-8 Jets

- **Expects delivery will start in 1960, possibly 1959, depending on Douglas commitment for USAF transport.**
- **Jet liners to use J57s; UAL chief calls turboprop talk 'shadowboxing,' says engines are unavailable.**

By William J. Coughlin

Los Angeles—United Air Lines will buy a fleet of jet transports this year, probably the Douglas DC-8 with Pratt & Whitney J57 engines, UAL president W. A. Patterson told AVIATION WEEK here exclusively last week.

Asked when he expected to place the order, Patterson answered: "I hope it is in the latter part of the year."

▶**$50 Million Plus**—Although Patterson did not disclose the number of planes he expects to buy, he said that $50 million would be a conservative figure for the initial investment United Air Lines is prepared to make for a jet transport fleet. He added that he expects the DC-8 price to be about $4.5-million apiece, including engines.

Patterson said that he is aiming at a 1960 date to have his jet transport fleet in operation, since it will take about five years to get delivery. However, he indicated that this might be advanced to 1959. Reviewing United philosophy, he added: "I thought a year ago that our decision on jet transports would be made in 1956-1957."

Whereas the jet transport in the past has appeared uneconomical, he said: "In the last six months and from figures I received yesterday from the Douglas Co., it now is encouraging; and over 1,000-mi. stages the jet promises to be better than the DC-6B, which has been very satisfactory. It is that which has convinced me the time has come for jets."

▶**Rejects Boeing Jet**—Patterson indicated that United Air Lines is not interested in buying the Boeing jet transport and said: "We disagree with Boeing in that we don't want an airplane designed for the military; we agree with Douglas in starting with an aircraft designed for commercial use."

Enlarging on this thinking, Patterson indicated that for the USAF jet tanker-transport competition, Douglas has proposed a military version of a commercial design, reversing the normal tendency to try to obtain a military contract first and then modify the design to meet civil requirements.

▶**No Word from AF**—Apparently Douglas has convinced Patterson that it intends to proceed with its commercial DC-8 jet transport even if it loses the Air Force tanker competition. As of last Monday, Patterson said Douglas had received no word as to how it stood in that competition.

However, the manufacturer's commitment would depend upon release that the company could get from the military to build a commercial aircraft aside from tanker-transport production, should Douglas get a USAF order for the jets.

▶**No Turboprops**—The United chief executive told AVIATION WEEK that turboprop transports are out of the picture so far as he is concerned.

"Talk about turboprops is shadowboxing. There is no engine available," he told this writer. "We will continue to buy the present type of aircraft, such as the Douglas DC-6B and DC-7, for present service and then we will go into pure jet. "We think that if you buy a turboprop plane today, your competitor can buy a jet and whip you by 200 mph."

Patterson said that United is writing off its present fleet of piston-engine airliners in five years. He also disclaimed that the airline has any interest in turboprops for short hauls. "We're going to wear out the Convairs first," he said, and added that United cannot operate such an expensive new aircraft into small cities.

▶**About 75 Passengers**—He said he expects the breakeven point on the commercial DC-8 to be about 52%. In regard to seating, he pointed out: "There is quite a debate about that. We would like to see about 75 passengers. Others want to go to 100 or more."

Patterson believes United could schedule more flights carrying a lower number of passengers and in that way attract a larger total volume than with fewer, higher-density services.

Concerning the DC-8's P&W J57, Patterson said: "The J57 by that time (1960) will have hundreds of thousands of hours on it. I have been in contact with the military and they tell me that the figures on maintenance of that engine are very fine."

NATO Entry: Mystere Light Tactical Fighter

A lightweight tactical fighter version of the Marcel Dassault Mystere is one of several entries submitted by North Atlantic Treaty Organization to Washington. In order of preference the designs are: Breguet, Mystere, Folland Gnat, Avro and Fiat G. 91. Recommendations are based on appraisal in comparison with NATO requirements for ground attack craft, which is apparently why sonic-supersonic Gnat interceptor ranks third on list. French entries would be powered by Bristol Orpheus medium-thrust jet.

Army Aviation Buying Fight Looms

Revamping of service's R&D setup indicates trend toward control of its aircraft procurement program.

By Claude Witze

U.S. Army has reorganized its research and development setup in what may be the first step to increased control over its aircraft development and production contracts.

Army aviation contracts now are supervised by the Air Force, serving as procurement agent for the Army.

► **Army View**—Immediate purpose of its R&D reorganization, according to the Army, is to insure centralized control and direction of all programs. The job has been given to Lt. Gen. Lyman L. Lemnitzer, Deputy Chief of Staff for Plans and Research, who will hold full responsibility for planning, general direction and supervision of all Army R&D.

The relation between the shift in control over development and aircraft procurement is remote at the present time. There is no denying, however, that top Army aviation men are less than happy with the present system. They feel their operation is handicapped by the fact that Army development and procurement money is channeled to the contractor by the Air Force.

USAF, they gripe in private, rests its main interest in big bombers and fast fighters. Result: Lightplane, helicopter and convertiplane projects are stepchildren in Air Materiel Command's nursery.

► **End of 'Off-the-Shelf'?**—There are high-ranking Army officers who feel it is inevitable that Army aviation will reach the point—possibly within a couple of years—where the service will have to buy its own aeronautical development and pick out the producers of its hardware.

This will mean an end to the traditional "off-the-shelf" procurement policy.

The theory has been that the Army would buy lightplanes and helicopters already in production, much as they buy trucks from the automobile industry.

That the theory has not worked has been evident, illustrated with some gusto last spring at a meeting in St. Louis. Here the Army assembled its helicopter manufacturers and told them bluntly that the entire rotary-wing program is being jeopardized by the high costs involved.

► **Industry View**—Army called on the industry to develop better transmissions, rotor blades, engines and other components. It demanded long serviceability in "off-the-shelf" aircraft, but has no money or direct contact to provide funds for development of such components.

"It is a good idea for the Army to tell us what is wrong," says one industry spokesman, "but until they are ready to fill out a check as part of an R&D program they are going to have to accept advances at the rate at which we can afford to make them."

The past year has seen a substantial expansion of Army aviation facilities. Top important installations at present are:

• **Camp Rucker, Ala.**, is the new home of the Army's aviation school and the board responsible for testing aircraft. A major growth of this installation is anticipated, but Army spokesmen emphasize that most of the work to be done involves adaptation of the existing facility, which was built for tank repair projects.

• **Fort Sill, Okla., Fort Riley, Kan.**, are the bases where the Army will activate its cargo aircraft units. Both crew and unit training will take place at these camps as personnel and equipment are prepared to go into the field.

• **Fort Eustis, Va.**, home of the world's first military heliport, will provide training for Army aviation maintenance personnel. Activity here will increase as more aircraft go into use.

• **Fort Huachuca, Ariz.**, is the Army electronics proving ground, home of the aviation signal center.

While the physical facilities have grown, Army Transportation Corps has expanded its staff of aeronautical experts.

► **Ultimate Goal**—Army spokesmen, cautious about discussing future plans, emphasize they have no intention of duplicating aeronautical research facilities already available at Wright Air Development Center, in the industry and at universities. But the ultimate goal appears clear: Within a couple of years, Army hopes to have the manpower and skill and administrative staff available so that it can administer its own aeronautical program.

There are recognized stumbling blocks in the path. An obvious one is Defense Department policy calling for unification in procurement. Another is the congressional abhorrence of anything that looks remotely like duplication.

However, a logical first step, lent emphasis by today's problems with "off-the-shelf" helicopters, the demand for faster progress in the field of convertiplanes and the Army's interest in cargo aircraft, might well be to give the Army greater autonomy in aviation research and development.

► **More R&D Next Year?**—Speculation along these lines is taboo in Army circles at present, but there are indications that the fiscal 1956 budget will call for a larger R&D program.

For the present, handling of this money probably will continue to be supervised by the Transportation Corps, working with its stipulated agents in the Air Research and Development Command of USAF.

However, for the long haul, indications are that the Army will find it necessary to pursue its own causes in aviation. Centralization of control over all R&D in the Office of the Deputy Chief of Staff for Plans and Research, put in effect on the eve of the new year, lifts this activity to a new level in Army organization.

It also may indicate a future closer liaison between the aviation industry and the fastest-growing part of the military market.

► **Consolidation**—Army spokesmen deny the reorganization means any change in the traditional autonomy of the individual branches over their own R&D programs. The move consolidates in Lemnitzer's office functions that were held by the Deputy Chief of Staff for Logistics and the Assistant Chiefs of Staff for Personnel and Operations.

But it is the measure of performance that counts. On the R&D put into new weapons, the Army says, this measure still will be judged by the technical services. Thus, Ordnance will not lose its control over the parenthood of new missiles. At the same time, Lemnitzer's office will have an opportunity to correlate pure research when it can be applied to more than one branch of the service.

Army's shuffle in the field of R&D has been hailed as a victory for the scientists who have been fighting for better planning and more freedom. Main gripe here was that the R&D effort was pretty well scattered. It involved—depending on the project—personnel, operations and logistics sections of the Army.

► **'Straight Line Command'**—Many recommendations were made by the Advisory Committee on Army Organization, scientists, industrialists and the Army Secretary's *ad hoc* committee. All of them called for more efficient use of scientists and the Army is convinced that the reorganization will result in improvement.

"A straight line command was needed," a top official told AVIATION WEEK, "and that meant a three-star general who would be responsible for the whole program. We hope now that we have eliminated past controversy by cutting R&D administration down to one staff."

BULGES AT TAILPIPE are a design trick to improve speed. YF-102A was built in only six months, went past Mach 1 on second flight.

Design Changes Make F-102 Supersonic

Half-a-dozen design changes, built around more power, less drag and lower weight, make Convair's YF-102A delta-winged interceptor supersonic in level flight.

On its second flight, made at Edwards AFB Dec. 21, the big plane passed through the Mach 1 mark in a climb to 35,000 ft. At that altitude, Convair engineering test pilot Richard Johnson leveled out and accelerated further into the supersonic range.

He reported no buffeting and good control characteristics through the transonic range.

These first photos of the modified airplane, which was built in 117 working days after completion of engineering, detail some of the layout changes. (Other YF-102A pictures are on p. 9.)

▶ **Newer Look**—From needle nose to blistered tail, the YF-102A is new in aerodynamic detail. The nose has been lengthened and apparently drooped a little further to give better visibility over the radome at high angles of attack.

• **Canopy has been redesigned** to take out the side bulges; it now features a near-flat side panel and layout similar to the canopy on Convair's F2Y Sea Dart. Below the canopy, new air inlets feed the bigger Pratt & Whitney J57 turbojet, rated at 16,000 lb. thrust with afterburner on.

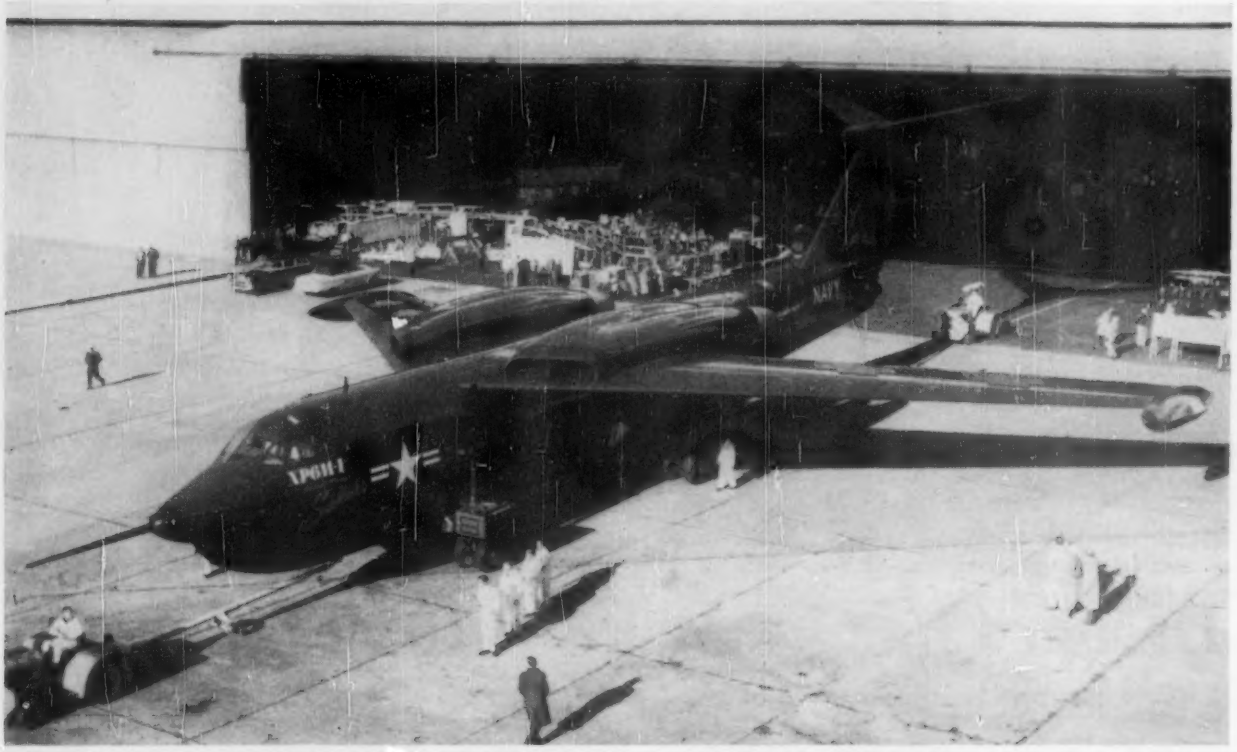
• **Wing leading edge** has been cambered to improve lift characteristics of the very thin airfoil; the camber stops just short of the tip and the transition from it to the unmodified tip section gives an "upswept" wingtip.

• **Two huge fairings** jut aft at each side of the tailpipe exit, presumably to fill in the channel section between wing, fuselage and vertical tail and thus delay flow breakaway. This is a standard stratagem to increase critical Mach number by a few hundredths.

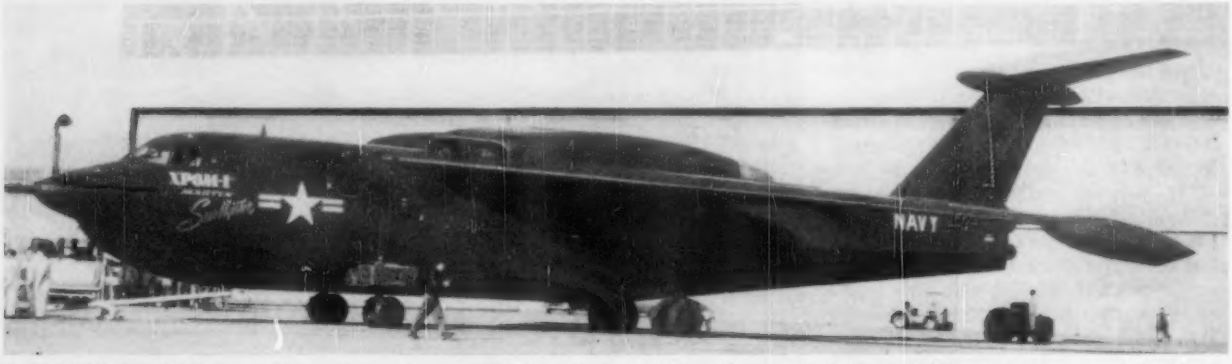
LATEST F-102 (left) shows many changes compared with earlier model next to it.

NEW CANOPY has flatter side panels, fewer braces. Air intakes also are different.

Work on the delta-winged interceptor is done at the San Diego plant of Convair division of General Dynamics Corp.



ROLLOUT of new Martin XP6M-1 SeaMaster near Baltimore, reveals unusual design of Navy's big minelayer and photo-recon flying boat.



STREAMLINED HULL carries five-man crew, has watertight rotary mine door. Pressure lock allows inflight access to unpressurized areas.

P6M Role: Jet Seaplane Strike Force

Martin Aircraft last week unveiled the XP6M-1 SeaMaster, its four-jet seaplane, and labeled it the prime weapon carrier of a "new concept in naval warfare"—the Seaplane Striking Force.

Primary missions of the SeaMaster are minelaying and photo-reconnaissance, according to Navy-approved data released with announcement that the first XP6M-1 has been completed and will fly this spring. However, the aircraft also was described as an attack seaplane and it was made clear that its 30,000-lb. payload could be used to carry anything —including bombs.

▶ **600-Mph. Class**—Powered by four Allison J71 jet engines, the sweptwing flying boat will cruise at 40,000 ft. at speeds of more than 600 mph. This, Martin said, is performance without use of afterburners, which are designed only to help get the aircraft off the water.

No figures are available on the size of the SeaMaster, except for the fact that the high T-shaped tail assembly towers nearly 35 ft. above the ground. The hull is slender and was designed to help the aircraft perform as well as land-based planes in the same category.

The engines, producing 9,500 lb. thrust each, are mounted in pairs at the top of the wing near the root. The intake ducts are rectangular, designed to eliminate spray problems as much as possible. Fuel tanks are sealed in the wings, which have plastic floats at each end to support and balance the aircraft in the water.

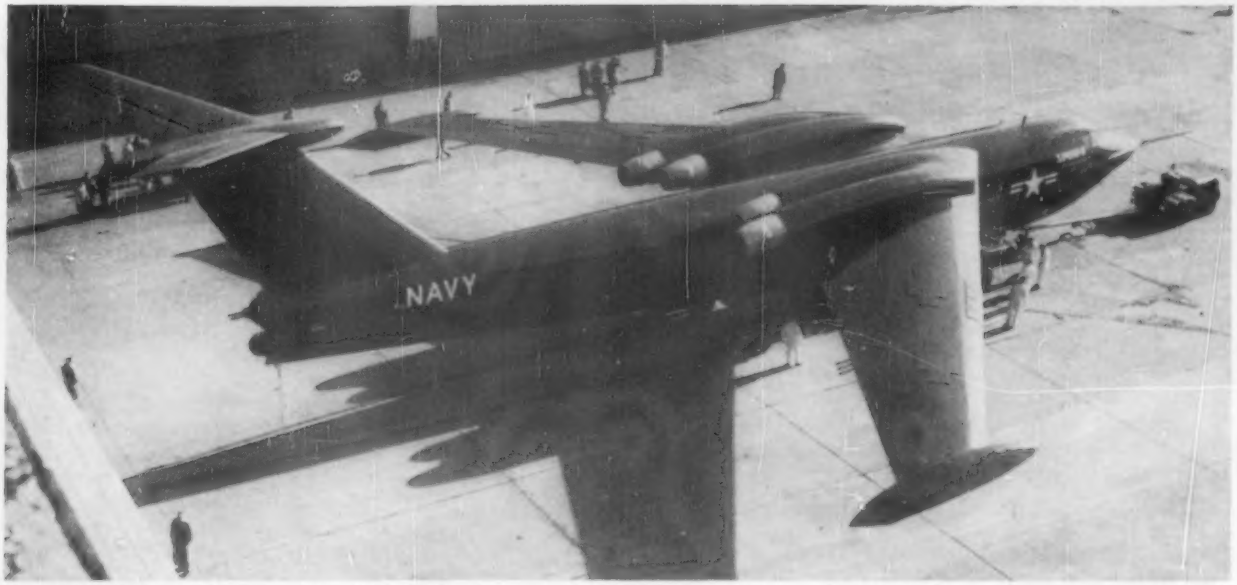
▶ **Effective ASW Weapon** — The XP6M-1 will be able to remain in operation for long periods, flying or afloat, and can operate in Sea-State 3, where the waves average six feet high. This indicates that the SeaMaster can operate in open seas 85 to 90% of the time.

Citing recent statements by Navy Secretary Charles S. Thomas and Assistant Secretary James H. Smith, Jr., in which they saw no limit to the potential size and utility of seaplanes, Martin said the SeaMaster is "the most effective aerial weapon ever developed" to fight the submarine and lay mines to harass enemy shipping.

The aircraft is equipped with a watertight rotary door in its belly, capable of carrying mine stores, a camera pod or

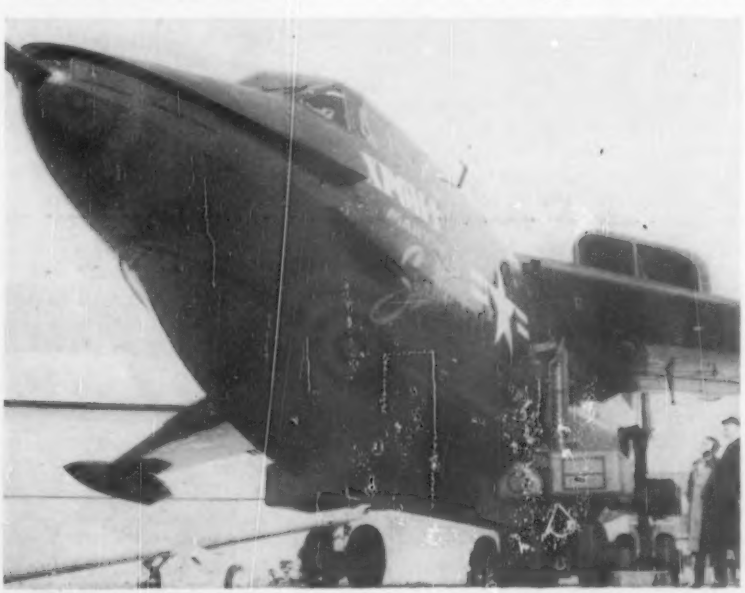
to 21,000 ft. against a true altitude of

MATS ferry pilots delivered 6,900 air-



AFTERBURNERS are fitted to four Allison J71 turbojets in nace'les atop swept wings. Plastic wingtip floats are permanently fixed.

NARROW-BEAM HULL mounted on multi-wheel beaching gear which will be detached after 600-mph.-class flying boat is launched.



BOW RADOME encloses radar scanner. Avionics compartment is below flight deck.

SWEPT T-TAIL towers at least three stories.

P6M Airliner?

Martin Aircraft sees good commercial possibilities in its jet-powered P6M SeaMaster.

The Martin company has a design available for a transport version of the new jet seaplane, according to Jess W. Sweetser, vice-president for sales.

"If the Navy wants a transport version," Sweetser said, "we are ready to build it. The same aircraft would have commercial application."

Payload of the P6M is 30,000 lb. It is powered by four Allison J71 engines.

other weapons. Whatever the load, it can be installed inside the door and exposed by turning the entire mechanism over. Loading is easiest while the plane is on the beach but can be accomplished at sea, through a hatch in the roof of the hull.

▶ **Special Dock**—The Seaplane Striking Force concept calls for a team consisting of tenders, tankers, ammunition ships and the aircraft. Martin disclosed that it is building an air-transportable dry dock and servicing dock facilities for seaplanes that will be ready for delivery to the Navy with the first test article in the P6M family.

The company already has built a portable dock that will permit servicing of the aircraft without beaching. When it is hauled from the water, the SeaMaster will be dragged from the water on a detachable landing gear equipped with floats to facilitate fastening it to the hull.

High performance of the SeaMaster —Martin says, "We don't take a back seat to any land-based aircraft in load, speed or range"—is made possible, according to its designers, by the high-thrust engines and aerodynamic advances. The takeoff run is less than that of a land-based aircraft of equivalent size, Martin claims.

▶ **Five-Man Crew**—In wartime, enthusiasts say, the Seaplane Striking Force will complement and strengthen U. S. airpower in many areas where we lack sufficient land-based striking forces. The dispersion of these forces it is held, would make it nearly impossible for an enemy to defend itself against all attacks.

The new seaplane carries a crew of five men, including pilot, co-pilot, navigator-minelayer, radio operator and armament defense operator. Only visible armament is a tail turret. There is a radome in the bow with a radar scanner.

In flight, the plane can be pressured to 21,000 ft. against a true altitude of 50,000 ft. There is a pressure lock for access to unpressurized areas during flight.

▶ **Crew Trolley**—In addition to the pilot compartment, upper part of the hull contains a flight deck for the crew and an entrance where anchor gear is stored.

Under the deck, the SeaMaster has an electronic and electrical compartment, the pressurized area and the mine bay. This compartment includes a portion of the main wing in the upper section, fuel tanks, air-conditioning and anti-icing equipment and tracks with a small trolley on which crew members can pull themselves back and forth above the stores.

Back of the mine bay and under the hatch on top of the hull is the mine-loading compartment. Back of this are more electronic gear and an auxiliary powerplant.

Hydroflaps, similar to those on the Martin P5M Marlin, are on both sides of the hull afterbody. Opened together, they serve as a brake; opened separately, they act as rudders to steer the aircraft on the water.

Engine overhaul and replacement will be performed through hinged panels that can be swung aside for maintenance work while the plane is on the ground or afloat. There are emergency escape facilities for the crew.

MATS '54 Record: 10,000 Oversea Trips

Military Air Transport Service flew about 1.5 billion passenger-miles, 100 million patient-miles and 500 million ton-miles across 110,000 miles of global air routes during 1954.

Records of MATS' three transport divisions:

• **Pacific.** Aircraft from this division crossed the Pacific 5,810 times carrying approximately 250,000 passengers and patients and 33,600 tons of cargo and mail.

MATS claims an unofficial record of 9 hr. 9 min. in a C-97 on the Tokyo-Honolulu flight, an average speed of 423 mph. across the 3,867-mi. distance.

• **Atlantic** Approximately 4,000 trips were made across the Atlantic carrying about a quarter-million passengers and 49,300 tons of cargo.

• **Continental.** This division airlifted about 90,000 passengers and patients and carried 8,476 tons of high priority cargo and mail.

"MATS not only carried out its peacetime support of the armed forces," Lt. Gen. Joseph Smith, the service's commander, said, "but also gained invaluable training in its wartime job of providing strategic airlift for the entire Department of Defense."

In addition to its transport duties, MATS ferry pilots delivered 6,900 aircraft throughout the world in 1954.

Longest aerial mercy mission in MATS history was the air evacuation of 500 French troops wounded in the fighting at Dienbienphu in Indo-China. The wounded were flown three quarters of the way around the world in Operation Wounded Warrior.

House Group Asks Probe of Subcontracts

A thorough congressional review of Defense subcontracting policies "in view of the wide area of controversy arising from both the direct subcontracting questions and the alleged effects of the weapons system concept" is called for in the annual report of the House Small Business Committee.

Utilization of government-owned facilities and equipment and administration of contracts awarded under the weapons system should be emphasized in the investigation, the committee said.

Other points made:

• "It is increasingly apparent that questionable or inadequate statistics have seriously hampered the proper evaluation . . . of how smaller producers fare in the defense program." Many procurement offices "regard a procurement as 'suitable' for performance by small business only if the contract has, in fact, been awarded to a small firm."

• Issuance of reports listing the volume of contracts to the 100 largest military prime contractors should be re-instituted.

• Purchasing policies should be examined by Congress to determine whether the large volume of negotiated contracting is warranted.

U. S. Sets Aircraft Export, Import Fees

A new schedule of fees for the licensing of aircraft exports and imports will go in effect Apr. 1, according to the Department of State. The fees apply to aircraft classified as implements of war.

The schedule provides for a variable charge ranging from $1 for a licensed shipment of $100, to $80 for a licensed shipment of $100,000 and over. For shipments valued at less than $100, no license is required.

Aircraft firms can submit fees with each application for a license. It is possible, State Department says, for regular exporters subject to the munitions regulation to make advance payments to cover expected charges over a period of six months or less.

The licenses are administered by the Office of Munitions Control, Department of State, Washington 25, D. C.

HYDRAULICS
PNEUMATICS
FUEL UNITS

DESIGNED AND MANUFACTURED TO EXACTING SPECIFICATIONS

EXAMPLE **1**

[illegible] SHUTOFF VALVE #102

Solenoid Pilot Operated
EXTREMELY LOW PRESSURE DROP
Current drain 0.5 amp. at 24 VDC
Continuous duty
OPERATING PRESSURE
4 TO 125 PSIG
Weight 1.5 lbs. for 1.5" tube size
Max. leakage 0.25 lbs. min. at 125 PSIG
Air temp. to +400° F.

EXAMPLE **2**

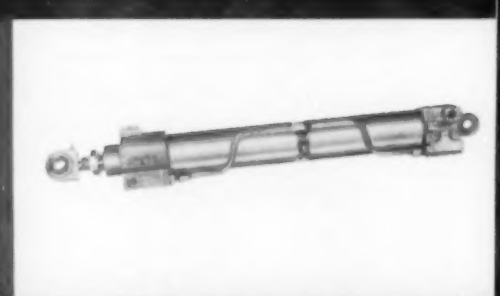
Solenoid Operated Pneumatic Valve #712
Fully Qualified

3 way 2 position normally closed
OPERATING PRESSURE
0 TO 3000 PSIG
current drain 1 amp. at 24 VDC max.
continuous duty
weight 1.1 lbs.
−65° F. to 160° F. ambient temperature
leakage 5 cubic inch per hour max.

EXAMPLE **3**

Double-Acting Hydraulic Cylinder #[illegible]
Fully Qualified per MIL-[illegible]

BUILT-IN SHUTTLE VALVE
24.33 inches retracted length
17.10 inches stroke
Operating pressure 3000 P.S.I.
Design compression load – 6700 pounds
WEIGHT ONLY 11 pounds
NO RETURN OF FLUID TO RESERVOIR DURING EXTENSION
Shuttle valve leakage less than 1 cu. in. min.



com·air
PRODUCTS INC.

1201 [illegible] VISTA, LOS ANGELES 23, CALIFORNIA
42 Lowell St., Port Washington, Long Island, N.Y.
[illegible] Grand, Elmwood 22, Illinois

DESIGNERS AND MANUFACTURERS OF HYDRAULIC, PNEUMATIC AND FUEL CONTROLS

VICKERS®

A Single *Responsible* Source for Aircraft Hydraulic Products

PUMPS

a. Fixed Displacement
b. Variable Displacement
   (1) Automatic Pressure Compensated
   (2) Cylinder Controlled
   (3) Electrically Depressurized
   (4) Flow Reversing
   (5) Servo Controlled

ACCUMULATORS

a. Spherical
b. Cylindrical

MOTORPUMPS, AUXILIARY

a. Electric Motor Driven Fixed Pumps
b. Electric Motor Driven Variable Pumps

PRESSURE CONTROLS

a. Relief Valves
b. Pressure Regulators
c. Sequence Valves
d. Pump Control Valves
e. Pressure Reducing Valves
f. Reducing Relief Valves
g. Brake Valves
h. Other Special Valves

MOTORS

a. Fixed Displacement
b. Constant Speed (Automatic)
c. Variable Displacement

DIRECTIONAL CONTROLS

a. Four Way Valves
b. Selector Valves
c. Servo Valves
d. Other Special Valves

OTHER

a. Hydraulic Drive Systems (for Armament, Electronics, Pneumatics and other)
   (1) Variable Proportional
   (2) Directly Proportional
   (3) Constant Speed
   (4) Specially Controlled
b. Winch Systems
   (1) Heavier Than Air
   (2) Lighter Than Air
   (3) Helicopters
c. Electro-Hydraulic Servo Systems
d. Special Hydraulic Devices

Various special devices not listed above are also manufactured. Phone, wire or write us for a proposal describing the aircraft hydraulic accessory required for your particular project. Details of the above products are available on request. Ask for the new General Bulletin A-5200-B which will introduce you to our complete Aircraft Products line.

VICKERS Incorporated
DIVISION OF THE SPERRY CORPORATION
1462 OAKMAN BLVD. • DETROIT 32, MICH.

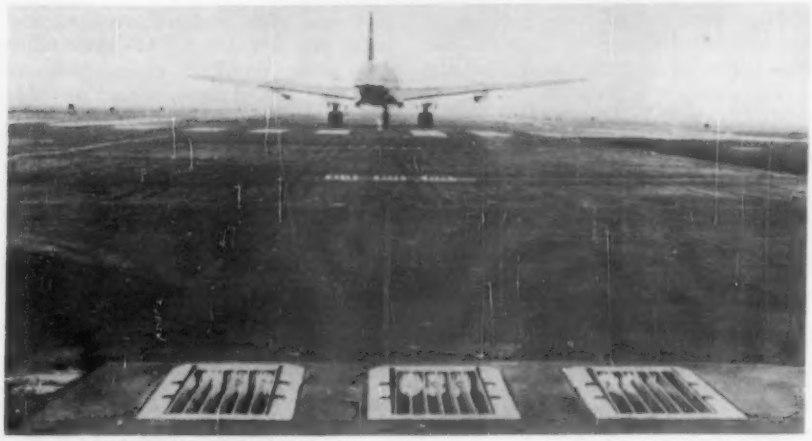
Application Engineering and Service Offices:
Arlington, Texas, P.O. Box 213
El Segundo, California, 2160 E. Imperial Highway
Detroit 32, Michigan, 1400 Oakman Blvd.
Additional Service Facilities at:
Miami Springs, Florida, 641 De Soto Drive

TELEPHONE: TOwnsend 8-5100 • TELEGRAMS: Vickers WUX Detroit • TELETYPE "TWX" DE89 • CABLE: Videt Detroit

6672

ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921

the overrun area cannot have center ... and the peculiarities of Navy flying, it ... tude and glide path information, and



'ELFAKA' OVERRUN LIGHTS are flush with runway at Amsterdam's Schipol Airport.

U.S. to Try Dutch Approach Lights

Joint USAF-CAA evaluation of 'Elfaka' may solve long civil-military pilot battle on lighting configurations.

An American evaluation of flush approach lights, a Dutch development already in use in The Netherlands and Denmark, will be carried out this year as a joint project of the U. S. Air Force and Civil Aeronautics Administration.

There is some hope, particularly in commercial aviation, that the tests will result in adoption of the flush light and final resolution of the long controversy between military and civilian pilots over approach light configurations.

▶ **Five-Group Test**—Installation of the system will be complete by spring, and the evaluation report should be ready by early fall of this year.

In addition to CAA and USAF pilots, the device will be tested by representatives of the Air Transport Assn., the Air Line Pilots Assn. and individual airlines. Site of the installation has not been selected.

CAA's present technical standard order on approach lighting is only a few months old (AVIATION WEEK Sept. 27, p. 99).

It provides for two configurations:

• **Type A**, initially developed by the British and accepted as an international standard, has a 3,000-ft. centerline of white bar lights leading to the end of the runway. There is a crossbar 1,000 ft. from the end of the runway, marked by a green threshold bar. This is the ALPA-ATA centerline system.

• **Type B**, a USAF configuration, has only 2,000 ft. of centerline lights, in red instead of white. They stop 1,000 ft. from the end of the runway with a red crossbar. The final 1,000 ft. before reaching the runway is clear and called the "overrun area," marked on the right by a single line of red lights and on the left by a triple row.

▶ **Airline Irritation**—CAA's order provides for Type A to be installed at civil airports and Type B where an overrun area is needed (airports shared with USAF). This type of installation remains a major source of irritation to airline pilots.

USAF demands an overrun area for reasons accepted as sound by CAA:

• Military planes, particularly fighters, have poor forward visibility during landing and a single center line of lights frequently would be behind the nose of the aircraft.

• Military planes, particularly jets, have a narrow range between the optimum approach speed and stalling speed. A slight error can result in undershooting the runway, and an area must be provided where touchdown can be made without hitting an obstruction.

• Military pilots, exposed to a greater calculated risk than commercial pilots, usually have less experience than professional transport pilots.

• Military pilots of fighter planes are alone and lack the monitorship and aid of a co-pilot during the crucial approach and landing.

▶ **ALPA Objections**—The USAF overrun area is frowned upon by ALPA pilots as an unnecessary hazard fringed with something that approaches intellectual dishonesty.

These men say USAF wants an extra 1,000 ft. of clear space regardless of the runway's length, whether the strip is 4,000 or 10,000 ft. long. An airplane, they assert, can land within a certain number of feet of runway and there is no part of the performance characteristics that calls for 1,000 ft. to be added to that figure for all aircraft.

According to CAA, the only reason

WORRY WON'T SOLVE YOUR TUBING PROBLEMS— But

THE CHANCES ARE 100 TO 1

TMI Already has the Answer For You!

The applications of small diameter stainless steel and alloy tubing in industry have proven the wisdom of TMI's *concentration* on the "problem children" facing engineers and management.

By combining a unique capacity to solve those problems with the ability to cold draw and shape tubing to split-hair tolerances (to .001" both I.D. and O.D.), TMI has earned the confidence of the most demanding customers!

Since 1941, we've come up with the answers: meeting and surpassing those extra difficult production and delivery specifications. Try TMI and see for yourself.

The Mark of Quality TMI

SPECIALISTS IN SMALL DIAMETER STAINLESS STEEL AND ALLOY TUBING

TUBE METHODS INC.

METALLURGISTS • ENGINEERS • MANUFACTURERS

BRIDGEPORT (Montgomery County), PA.

the overrun area cannot have center lights, thereby meeting ALPA-ATA demands as well as the military requirements, is that until recently there has been no satisfactory flush light.

▶ **Dutch Solution**—Now come the Dutch with the "Elfaka" runway light, a fixture encased in a box and buried in the ground with a longitudinal grate across the top. The light can be seen by an approaching pilot but the fixture offers no obstruction on the runway.

Feeling is strong in ATA, ALPA and CAA circles that this type of fixture, installed in the 1,000-ft. overrun area to provide a full 3,000-ft. centerline in the Type B installation, will be satisfactory to civil and USAF pilots.

USAF spokesmen so far have reserved their opinion, pending this year's tests, but indicate they will accept a flush light of the Elfaka type if the overrun border lights are retained as well.

▶ **Current Confusion**—Apart from the basic disagreement on approach light configuration, there are a number of border opinions and situations that add to current confusion on the subject.

One of these, possibly the most important, is the U. S. Navy's policy of installing a third type of approach light system at its air stations. Based on wide experience, long experimentation and the peculiarities of Navy flying, it has concluded that both Types A and B as approved by CAA are inadequate.

The Navy configuration provides a 3,000-ft. centerline of red lights, a red crossbar 1,000 ft. from the runway and a green threshold bar. In addition, however, there are 3,000 ft. of sloping white lights providing a funnel to the end of the runway. These are equipped with angled bars of light situated so the pilot can tell by the pattern and color just what his position is on the glide path.

When the pilot views the Navy approach system from exactly on the three-degree glide path, he sees a straight line of lights leading to the touchdown point. If he is below the glide path, the lines will be broken by bars that stick up above the line of lights. If he is above the glide path, the bars will angle inboard or below the line. In short, the system is designed to combine approach lights with a type of visual landing aid.

▶ **'Christmas Tree' System**—Both civilian and USAF spokesmen criticize the Navy system, call it a "confusing Christmas tree" and dismiss the idea as one accepted and understood only by Navy pilots.

Navy spokesmen say the system was perfected with help from CAA experts, claim it is the only one providing altitude and glide path information, and point out that—like USAF—their pilots have some problems characteristic of aircraft designed for shipboard use.

In addition, they say their philosophy is to keep the pilot out of trouble, not provide a special facility for him if he gets in trouble. CAA's stand on this is made clear in their technical standard order, which lists the Navy configuration as Type C and forbids its installation on civil airports.

Present status of the Navy's approach light system is that it is in use at Patuxent River, Md., will be installed at five other naval air stations with fiscal 1955 funds. In all, about 25 installations are programmed.

▶ **Fund Control**—Another important factor in the approach light controversy is the control over funds spent for CAA-approved installations.

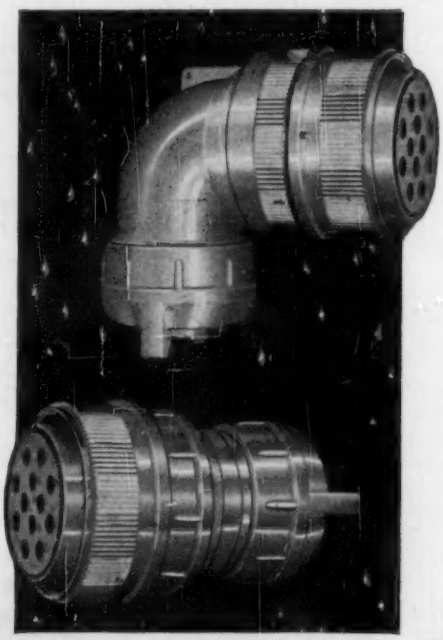
Type A lighting systems have been put in or programmed by CAA at Newark, Ft. Worth, San Francisco and Denver.

Type B systems, financed by military funds from USAF and/or the National Guard, are in operation at Knoxville, Pittsburgh, Boston and Salt Lake City.

All this construction has been since international acceptance of the centerline standard in 1952.

Feeling among ALPA officials is that

Now! BENDIX·SCINFLEX waterproof plugs



for use with multi-conductor cables

These new Bendix*-Scinflex *waterproof* plugs are a modification of our standard AN type "E" (environment resistant) connector. They are designed to meet all "E" performance requirements when used with multi-conductor cables. Each plug includes a modified AN3057B cable clamp which provides inward radial compression on multi-conductor cables. This unique feature completely eliminates cable strain—a common source of circuit trouble.

In addition, there are gaskets at all mating surfaces and an accessory sleeve is available to accommodate an extreme range of cable sizes. A folder describing this new waterproof plug—and the various sizes in which it is manufactured—may be obtained by writing our Sales Department.

* TRADE-MARK

THESE BUILT-IN FEATURES ASSURE TOP PROTECTION AGAINST CIRCUIT FAILURE:

Shock and Vibration Resistant

Die Cast Aluminum Shell

Cadmium Plate—Olive Drab Finish

Moisture-Proof, Pressurized

High Arc Resistance,

High Dielectric Strength

Silver-Plated Contacts

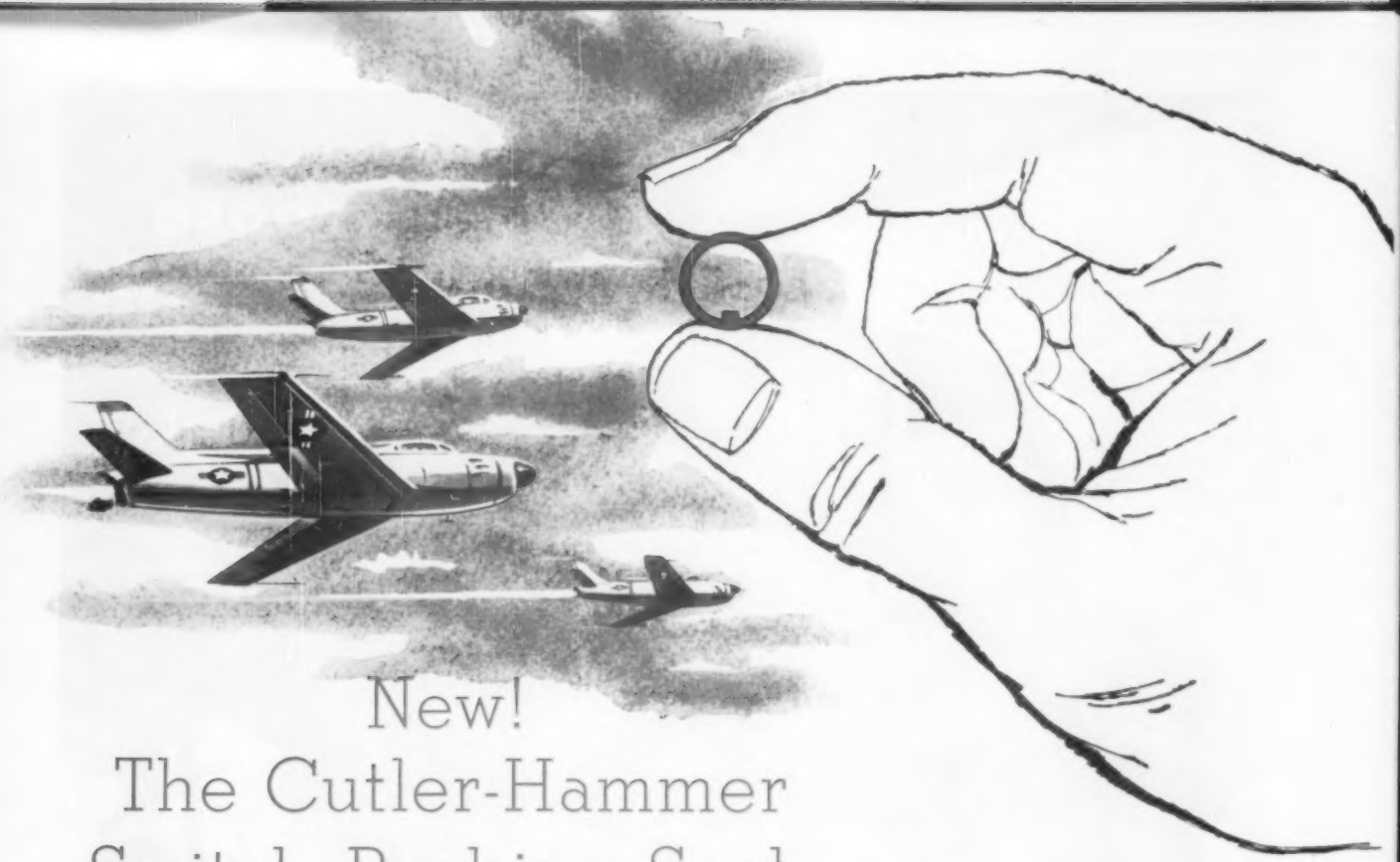
Resilient Inserts

SCINTILLA DIVISION Bendix AVIATION CORPORATION *SIDNEY, NEW YORK*

Export Sales: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

Bendix

Factory Branch Offices: 117 E. Providencia Avenue, Burbank, California • Brouwer Building, 176 W. Wisconsin Avenue, Milwaukee, Wisconsin • Stephenson Building, 6560 Cass Avenue, Detroit 2, Michigan • 512 West Avenue, Jenkintown, Pennsylvania • 8401 Cedar Springs Rd., Dallas 19, Texas • American Building, 4 South Main Street, Dayton 2, Ohio



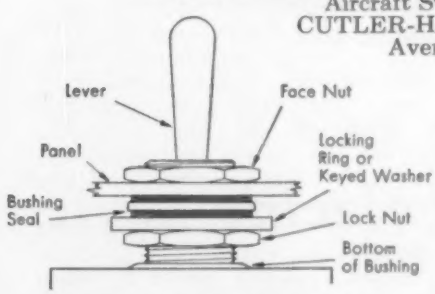
New! The Cutler-Hammer Switch Bushing Seal

What is it worth...
15¢ or $1,500,000?

The Cutler-Hammer Switch Bushing Seal costs less than a package of cigarettes. But that is certainly *not* the basis on which it was engineered . . . or the basis on which it should be specified. Circumstances can make one single seal the most vital unit of an entire plane. Its real worth can only be measured by the cost of its possible failure. That was the standard to which the Cutler-Hammer Switch Bushing Seal was designed . . . to give complete security *every* time.

The Cutler-Hammer Bushing Seal does not require a definite spacing between the switch body and the panel for effectiveness. Its silicone element molded to a stainless steel cup flows under compression to positively close all possible openings for leakage, including the keyway in the switch bushing. It is so secure that *this* seal can withstand more than 20 pounds per square inch of water pressure.

Be sure you have complete information on Cutler-Hammer Switch Bushing Seals and Cutler-Hammer Sealed Lever Aircraft Switches. Write or wire today. CUTLER-HAMMER, Inc., 1471 St. Paul Avenue, Milwaukee 1, Wisconsin.



Under compression silicone rubber shown in red flows into openings and metal-to-metal contact of mounting hardware results.

Simple–Sturdy–Dependable

Compression of the silicone element of the Cutler-Hammer Bushing Seal forces the silastic material to close all possible leakage openings. Switch can always be mounted properly with only correct projection of the switch bushing for face nut on front of panel.

What you should know about Cutler-Hammer

Cutler-Hammer has long held the respect of the aircraft industry because this company has been *part* of the aircraft industry for 35 years. It has never been an opportunist supplier. It has *pioneered* the designs others have followed. It has sought to serve, not merely sell. It has been in the forefront of all cooperative activity in standardization and long-range planning. It has supplied complete *lines* of equipment, not merely the items of widest use and most profitable manufacture. Today, as for the decades past, Cutler-Hammer engineers are working closely with the aircraft industry's leaders . . . thinking ahead, planning, designing and building for the future. Here is the record:

1920 Cutler-Hammer designed and manufactured the first line of switches ever created specifically for use in aircraft.

1938 Cutler-Hammer designed and manufactured the first d-c power relay ever created specifically for use in aircraft.

1943 Cutler-Hammer designed and manufactured the first a-c power relay ever created specifically for use in aircraft.

1949 Cutler-Hammer started development of the first environment-free power relays for use in aircraft.

1953 Cutler-Hammer submitted samples and certified test reports on the first hermetically sealed power relay to WADC and Bu. Aer. Cutler-Hammer configuration adopted as industry standard by ASG.

CUTLER-HAMMER
AIRCRAFT CONTROL
C-H

one multi-purpose unit

for starting . . .
for servicing . . .
for testing . . .
for towing . . .

One compact, self-propelled, multi-purpose unit for aircraft and guided missiles.

Designed and manufactured by Consolidated, this complete source of ground support power is now serving the United States Air Force, Navy and Marine Corps.

This all-purpose unit can deliver all or any combination of the following:

a.c. power
400 Cycles, 3 phase and 1 phase, close regulated

d.c. power
28.5 Volts, up to 2250 amp.

hydraulics
Up to 3000 psi—with oil cooler

compressor
Air supply up to 3500 psi, 13.5 cfm, 1,000 cu. in. reservoir

towing
All-wheel drive—mechanical transmission or torque converter—tows aircraft up to 80,000 lb.

For individual ground service and testing requirements, Consolidated can supply these and numerous other proven units with the most exact power combinations needed, or will develop equipment to meet your most complex problems in aircraft and guided missile support.

For further information, write

CONSOLIDATED
diesel electric CORPORATION
AIRCRAFT EQUIPMENT DIVISION
STAMFORD · CONNECTICUT

OFFICES IN
DAYTON, OHIO
B-4 TALBOT BUILDING
SANTA ANA, CALIFORNIA
SPURGEON BUILDING
WASHINGTON, D. C.
CAFRITZ BUILDING,

Type B will be prevalent within a few years unless a new compromise is reached, possibly through acceptance of the Elfaka light or some modification of it. Reason: The military have more money to spend on approach lights than CAA is able to win from Congress in its annual appropriations.

► **Congressional Decision?**—Bolstering the USAF case, the airline pilots fear, is the nation's need for stronger air defenses and the growing authenticity of the argument that more fields must be readied for use by the Air Force in case of emergency.

There is some talk in ALPA circles that the only sensible and enforceable program for standardization of approach lights must come from those who originate funds—congressmen. This theory would have Congress centralize control over all approach light expenditures in one agency empowered to carry out a unified program.

Present U. S. situation is that about 60 airports have non-standard approach lighting systems. A few of these—Washington, New York's LaGuardia and Idlewild, Indianapolis and Arcata, Calif.—have slope line lights going back before 1952 when this was the CAA standard. The slope line never was accepted by ATA or the airline pilots, who hold that slope lines are misleading, require too much interpretation to achieve both vertical and lateral control.

In addition to the joint CAA-USAF evaluation program for the flush light, the two agencies today are considering establishment of a joint committee to study the entire landing aid problem at joint-use airports. Given agreement on adoption of a flush light that will resolve the civil-military conflict in this area, it is highly possible that other differences will be settled by joint action.

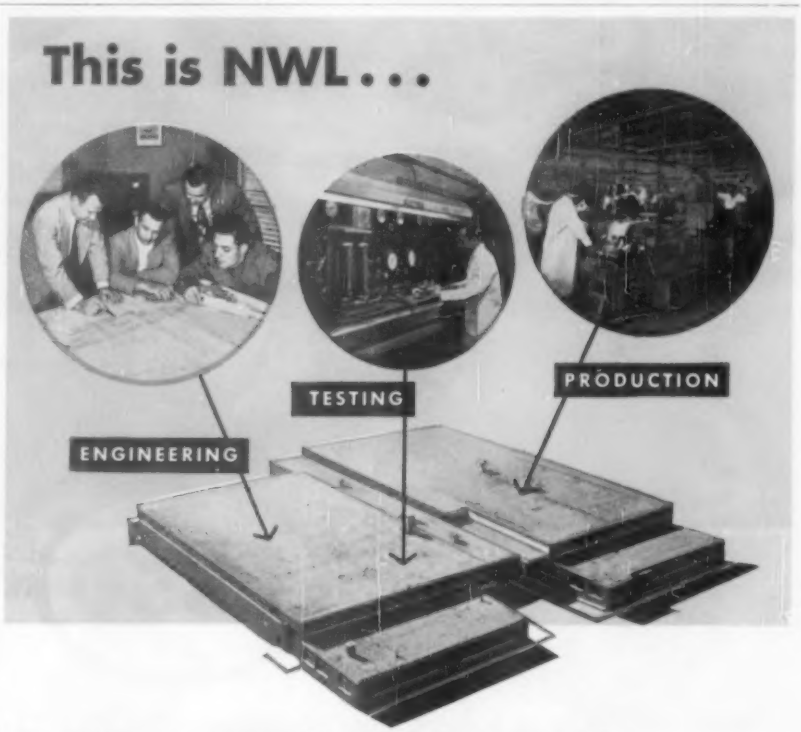
WHAT'S NEW

Telling the Market

How to Pack It is 32-page illustrated booklet describing various styles and types of corrugated boxes for a variety of products. Hinde & Dauche, Sandusky, Ohio. . . . Four-page bulletin 1-100 describes new **variable area flowmeter** that combines installation simplicity of an orifice with constant pressure drop and linear signal output of the variable-area type. Write Devicengineering, 1701 Walnut St., Philadelphia 3. . . . Complete line of **precision instrument parts and mechanical components,** including shafts, gears, collars, couplings, differentials, etc., is described in 64-page catalog. Complete tolerance specs are given, so engineer can prove out his design with these items and breadboard equipment. PIC Design Corp., 160 Atlantic Ave., Lynbrook, L. I., N. Y.

Fiberglass laminate parts produced for the aircraft industry by the Paul Omohundro Co. are described in illustrated brochure available from the firm, at Box 696, Paramount, Calif. . . . Properties and shapes of **Teflon products** are described in 6-page folder published by Micromold Products Corp., 11 Centre Pl., Yonkers, N. Y. . . . ABC's of **molded and extruded rubber and plastics** are covered in 16-page buying guide available from General Tire & Rubber Co., Industrial Products Div., Wabash, Ind. . . . **Koppers expandable polystyrene,** a new foamable, expanded plastic, is described in 24-page bulletin C-4-204 put out by the Koppers Co., Inc., Chemical Div., Koppers Bldg., Pittsburgh 19.

Comprehensive reference file on the complete line of **Morse cam clutches** for indexing, overrunning and backstopping operations, is contained in bulletins C 11-54 A, B, C, D, E. Write: Morse Chain Co., 7601 Central Ave., Detroit 10. . . . New manual shows how a single **Di-Acro brake** can be converted into a bar folder, tab



a top aeronautics team engaged exclusively in aircraft equipment

At NWL, Project Teams of experienced aircraft accessory personnel coordinate the combined skills of NWL design, development, prototype and quantity precision production to assist you in producing advanced type aircraft control systems and components. The NWL Team offers you a complete package program—or any portion to fit your needs.

- Fluid Servo Mechanisms and Components
- Hydraulic and Pneumatic Actuators and Valves
- Electro Servo Valves
- Electro — mechanical Actuators and Controls
- Pumping Devices and Pressure Regulators

Your inquiry regarding NWL services and facilities will receive prompt attention. Address:

NWL
NATIONAL WATER LIFT CO.
2220 PALMER AVENUE
KALAMAZOO, MICHIGAN
The Lift Line

FOR EXECUTIVES "ON THE WAY UP"...

THE PIPER APACHE

Esso

More and more of today's smart businessmen are flying their own or company planes. They've taken to the air because they have to go places – with a speed and convenience entirely free of schedules.

For quality and service you can depend on Esso Aviation Products – chosen by many leading airlines and aircraft and engine builders.

There are over 600 Esso Dealer Airports ready to serve your private or company plane with a dependable line of high quality Esso Aviation fuels and lubricants. Products proved by over 44 years of actual flying.

For extra convenience take along an Esso Credit Card. You and your company can charge lubrication, tire and battery services, landing fees, over-night storage in transit and minor emergency repairs.

Look for the famous Esso Wings for quality, service and convenience.

Esso

AVIATION PRODUCTS

SOLD By Maine, N. H., Vt., Mass., R. I., Conn., N. Y., N. J., Penna., Ohio, Del., Md., D. C., Va., W. Va., Ky., N. C., S. C., Ga., Fla., Ala., Miss., Tenn., Ark., La., Texas.

former, radius former, open end brake, standard brake, or box and pan brake. The 16-page illustrated manual is available from O'Neil-Irwin Mfg. Co., 516 Eighth Ave., Lake City, Minn. . . . Spotlight on Facilities, latest issue of Daco Doings, describes company's machine tools and facilities for design, tooling and production of **high-precision instruments.** To get on Daco Doings mailing list, write Daco Machine & Tool Co., 202 Tillary St., Brooklyn 1, N. Y. . . . Bulletin describes new Trans-o-Mator, a standard **multiple-station straight-line transfer machine** which the user tools for his own use in light machining, forming, pressing, assembly and inspection operations. Write to Ferguson Machine & Tool Co., Inc., Roller Gear Div., P. O. Box 191, St. Louis 21.

Super Alloys is 24-page pamphlet describing **high-strength heat- and corrosion-resistant materials** designed for use in critical parts of jet engines, turbosuperchargers, rockets and guided missiles. Available from Universal-Cyclops Steel Corp., Dept. 37, Bridgeville, Pa. . . . American Metaseal Mfg. Corp., 607 65th St., West New York, N. J., has put out 8-page brochure describing **impregnation of porous castings. . . .Titanium foil,** rolled to very close tolerances and thin gages, is described in Technical Data Bulletin 100 available from American Silver Co., Inc., 36-07 Prince St., Flushing, N. Y.

Publications Received

• **Canada's Flying Heritage,** by Frank H. Ellis, pub. by University of Toronto Press, Toronto, Canada, 404 pp., $7.95. The author, a pioneer Canadian pilot and member of the Early Birds, has gathered between the covers of this 8x11½-in. book more than 300 illustrations plus data and anecdotes concerning Canada's aviation pioneers. He wrote, according to the flyleaf, "not merely to record the significant events of Canadian aviation, but to pay tribute to the forgotten flyers who flew by guess and by God or with calculating caution—for the sheer love of flying—in the early days."

The publisher has received a grant from Imperial Oil, Ltd., which makes it possible to sell the book below cost.

• **Table of the Gamma Function for Complex Arguments**—National Bureau of Standards, Applied Mathematics Series 34—Order from Government Printing Office, Washington 25, D. C. $2.00; 105 pp. Table of the complex gamma function presented here makes this function as accessible to workers as the more familiar exponential and trigonometric functions.

• **Rules of the Air**—Edited by John Dohm—Pub. by Pan-American Navigation Service, 12021 Ventura Blvd., North Hollywood, Calif. $2.00; 182 pp. Manual is an attempt to bring together in a convenient form all the regulations, laws, and procedures that in one way or another affect the majority of pilots, both in the air and on the ground.

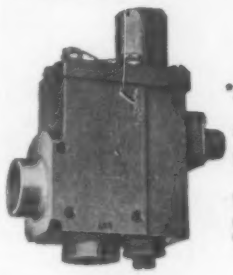
ADEL Hydraulic

SHUT OFF VALVES

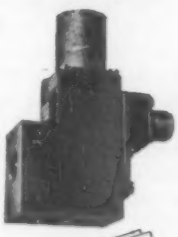
(Solenoid Operated)

PRODUCED TO RIGID AIRCRAFT STANDARDS

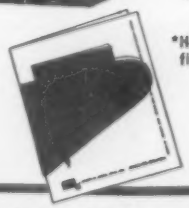
26038 WITH INTEGRAL RELIEF.
NORMALLY CLOSED.
¼" and ⅜" LINE SIZES.
Operating pressure: 350 psi;
Relieves inlet to outlet within 500 to 700 psi range.
Weight: 0.60 lb.
(Also available in 1500 and 3000 psi capacities.)



*25853 PILOT OPERATED.
NORMALLY CLOSED.
⅜" and ½" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 1.45 lb.
(Also available with manual override or normally open.)

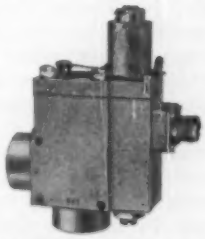


*26610 PILOT OPERATED.
NORMALLY OPEN.
¼" and ⅜" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 0.81 lb.
(Also available normally closed.)



*High Flow Capacity Valve with filtered pilot circuit.

FLUID: Specs. MIL-O-5606 or MIL-F-7083.
ELECTRICAL RANGE: 18-30 VDC.
SOLENOID DUTY: Continuous.
CURRENT DRAIN: 0.5 Amp at 24 VDC.
TEMPERATURE RANGE: —65°F to +250°F.
LIGHTWEIGHT, COMPACT, CORROSION RESISTANT CONSTRUCTION.



*25670 PILOT OPERATED. WITH MANUAL OVERRIDE.
NORMALLY CLOSED.
¾" and ⅝" LINE SIZES.
Operating pressure: 3000 psi.
Weight: 1.58 lb.
(Also available normally open without manual override.)

Write for new, descriptive Brochure containing detailed information on ADEL's line of Aircraft Equipment and facilities. Address ADEL DIVISION, GENERAL METALS CORPORATION, 10775 Van Owen St., Burbank, Calif.

ADEL produces a complete line of Aircraft HYDRAULIC & PNEUMATIC CONTROL EQUIPMENT, HEATER, ANTI-ICING & FUEL SYSTEM EQUIPMENT, ENGINE ACCESSORIES AND LINE SUPPORTS.

ADEL LEADER IN HYDRAULICS

DIVISION OF GENERAL METALS CORPORATION • BURBANK, CALIF. • HUNTINGTON, W. VA.

CANADIAN REPRESENTATIVE RAILWAY & POWER ENGINEERING CORPORATION LIMITED

TRIPLE TEST at Bell's Wheatfield plant typifies intensity of rocket development effort. Jet of nearest rocket has blasted snow away.

Bell Builds Rocket Engine Knowhow

By David A. Anderton

Buffalo, N. Y.—An aluminum-alloy rocket motor, which can be built quickly and cheaply from standard alloys, is a current high-water mark of Bell Aircraft Corp.'s extensive rocket motor development program.

Experimental aluminum-alloy units have been fired with acid-JP-4 propellant combination for continuous runs of almost 10 minutes duration; individual motors have logged more than one hour—a long life under the rigorous conditions of rocket combustion.

With 21 test cells in operation at their Wheatfield plant, and a backlog of more than 16,000 individual motor runs on acid-JP-4, Bell's liquid-rocket development effort is one of the country's largest.

▶**Motor Test**—Highlight of a recent trip by AVIATION WEEK's editors through Bell's extensive facilities was a five-minute run on one of the aluminum-alloy motors rated at about 6,000-lb. thrust.

AERIAL VIEW OF WHEATFIELD plant shows long row of rocket test cells. Near cells, newest test facility to be added, discharge toward earth bunker.

The motor was mounted on a typical thrust-measuring stand in a reinforced concrete test cell. Control and instrumentation harnesses ran behind a protective shield into the adjacent control house and back to the instrumentation room.

Inside the control room, the test engineer stood by the operator's panel, where he could watch the performance of the motor through the thick bullet-proof glass windows set into the heavy walls. Behind him stood another engineering observer to watch the clock and other dials on the instrument panel.

Two rubber-booted technicians stomped into the control room through the steel blast door, and dogged it closed. The siren began its warning ululation. The operator started the test run.

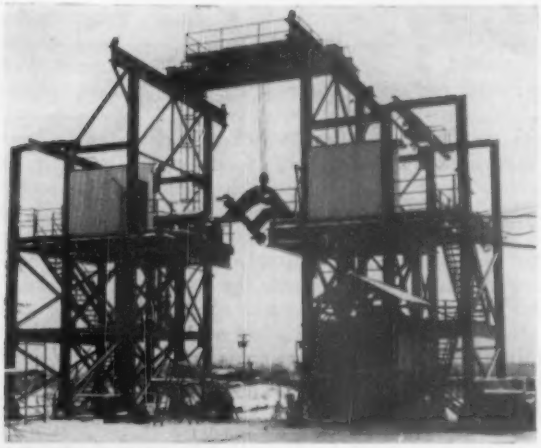
▶**Smooth Operation**—To the observer whose ears have been hardened to the tortured shriek of ragged combustion, to hard and explosive starts, the smoothness of the Bell unit was remarkable.

The start was positive; thrust built up rapidly but without the explosive beginning that is characteristic of so many motor runs. Shock diamonds, the visible indication of supersonic flow in the ex-

problem. The first is to let the motor

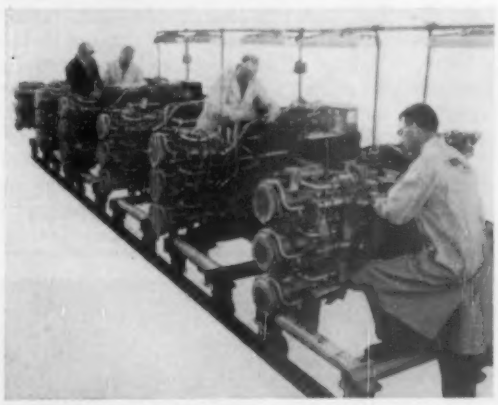
Considerable research effort is going

handle up to 50,000-lb. thrust at the

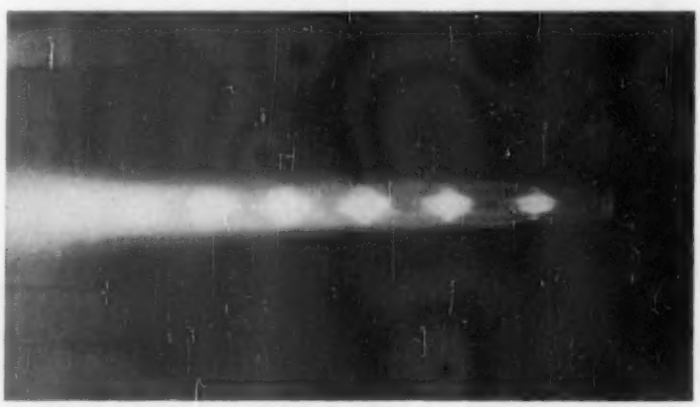


ATTITUDE TOWER can suspend complete missile or powerplant at any desired attitude under full thrust.

RECORD ROOM handles tremendous amount of input instrumentation data, records it on Speedomax units. This is smaller of two such rooms.



PRODUCTION LINE of rocket motors. These 3-barreled powerplants typify liquid-propellant rocket design.



DIAMONDS in exhaust from liquid-propellant rocket engine furnish quick check of engine operation by their steadiness, size and clarity.

haust jet, were incandescent yellow against the darker yellow of the flame; their position varied only once during the run, and that was when the mixture ratio was changed deliberately.

For several noisy minutes the motor blasted in an unmodulated roar across the concrete apron behind the test cell; its noise was deafening even through the thick protective walls around the control room.

Behind the engineer controlling the run stood another engineer watching the clock. The hand swept toward shutdown time; at the mark, he tapped the test engineer, signaling for the shutdown. The propellant valves were closed. There was no flame regurgitation, no pulsing, no uneven combustion. The motor and the noise simply stopped.

▶ **Instrumentation**—During the run, remote instrumentation in one of two large control rooms was monitoring the many parameters of the test. All data were being fed through patchboards—like huge telephone switchboards—into Speedomax recorders, oscillographs and other test instrumentation.

After the run, the test points of 60 to 80 parameters are stored on IBM punch cards to add to the accumulating mountain of basic data on motors and propellants. When some engineer wants to find out the effects of mixture ratio change, or chamber pressure change, or wants to correlate data from similar runs, the punch cards are run through and he gets his data in minutes instead of days.

Bell has two instrument and control rooms; walls of both are lined with Speedomax recorders and test equipment. There are 60 units in the small room, and 120 in the larger room, still being completed.

Speedomax handles data that appears up to about 50 cycles per second. Oscillographs bracket the frequencies up to about 300 cps., and special instrumentation developed at Bell records measurements up to 8,000 cps.

Work load for the test cells and instrumentation peaks at about 20 runs per day; the need for automatic recording and processing is obvious.

▶ **Bell Goals**—One of the aims of the rocket program is a higher specific impulse, William M. Smith, Bell's chief rocket engineer, told AVIATION WEEK.

(Specific impulse is the rocket engineer's way of rating an engine; it is a number defining the pounds of thrust obtained in consuming one pound per second of propellants. Symbol for specific impulse is I_{sp}; units are seconds. Specific impulse could also be considered as the reciprocal of specific fuel consumption. Typical values for current rocket motors are above 200 sec., and as high as 230 sec.)

Motors developed at Bell are running close to their practical efficiency limits now, so that new propellants are being investigated.

Smith said that Bell was beginning to study fuels containing metal suspensions, in order to pick up some performance gains.

"We've had no problems with combustion instability for the past year and a half," Smith said.

▶ **Motor Design**—Typical rocket motors consist of three basic parts: an injector head, through which fuel and oxidizer are fed to the motor; a cylindrical combustion chamber; and a convergent-divergent supersonic nozzle.

An enormous amount of heat is generated in a tiny volume, and produces the major problem in rocket motor design: efficient cooling of the motor.

There have been two solutions to the

they will be able eventually to shorten *the ability of Herrmann Goering. In Hitler, and not caring whether he saw*

problem. The first is to let the motor burn uncooled, protected by a high-temperature-resistant liner. This is the solution generally adopted for solid-propellant motors where the thrust duration is a matter of a few seconds, or for liquid-fuel motors of moderate performance.

The second is to use the fuel as a coolant, by circulating it in a jacket around the combustion chambers and nozzle. This concept is called a "regenerative motor."

▶**Bell Standard**—The standard motor under test and continuing development at Bell is a single thrust chamber of regenerative design. The development of this kind of motor has gone through several stages, including the classical approach of the concentric-shell motor.

Many rocket motors are designed with concentric shells. The body is formed of two high-strength steel (generally a stainless alloy) cylinders separated by a distance on the order of one-eighth of an inch. In this hollow space, fuel is circulated from the nozzle toward the head in order to cool the motor.

Other structural variations have been tried at Bell and elsewhere, but the basic design is common to all: a combustion chamber, jacketed and cooled by one of the propellants. Most specific design solutions remain classified.

One of the most exciting current developments in rocket motor design is the aluminum-alloy motor, credited to Harry S. Myers and Joseph R. Piselli, section head under Smith. Basically of regenerative layout, the aluminum-alloy motor is radically simple—and highly classified.

▶**Other Work**—Smith says there is considerable variety in rocket motor development at Bell, in addition to production of complete powerplants. It has been reported (AVIATION WEEK Dec. 13, p. 11) that Bell is building rocket motors for the Army's Nike surface-to-air missile.

"We make our own valves, controls, regulators, turbine pumps, tanks and pressure vessels," Smith says, explaining that components for rocket powerplants have to be matched carefully to the particular engine. Few such items are production hardware with any other manufacturer of equipment, so Bell is forced into building its own.

In the case of research aircraft like the X-1, the powerplants were developed elsewhere to Bell specifications. On the X-1, X-1A, B and D, powerplant responsibility was given to Reaction Motors, Inc.; Bell set the requirements and after delivery, assumed the responsibility for installation of the engine.

On the X-2, a similar arrangement was made for the Curtiss-Wright throttlable engine.

Considerable research effort is going into ceramic-lined motors for USAF, Smith adds. In this development, a ceramic insert is used in the nozzle and as a chamber liner.

"We have done some work on variable-thrust engines, too," says Smith, "But using a number of motors seems preferable in most applications."

▶**Two Facilities**—Bell does its rocket development at two facilities: Wheatfield plant, where the major research and development effort is centered, and the nearby Bell Test Center (USAF Plant No. 38) operated for the USAF.

Wheatfield has 21 completed test cells, with four under construction. Most of the work done there is on single components—a motor, a pump, a turbine—and falls into the category of research or development.

Operations at the test center are divided into two phases. The first is acceptance testing of deliverable hardware, such as a complete missile or a complete powerplant system. This work is separate from the motor development work, and is administered by Bell's Test Dept.

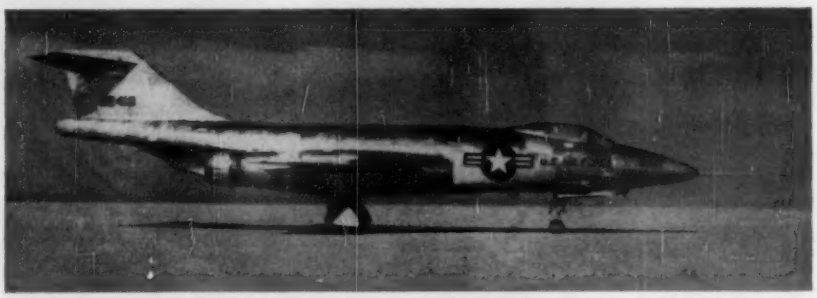
The second phase is research and development on complete units, which is under Smith's jurisdiction. "We can handle up to 50,000-lb. thrust at the test center," Smith says, "and maybe we could go to 100,000-lb. thrust. We hope to compete on large powerplants in that thrust bracket."

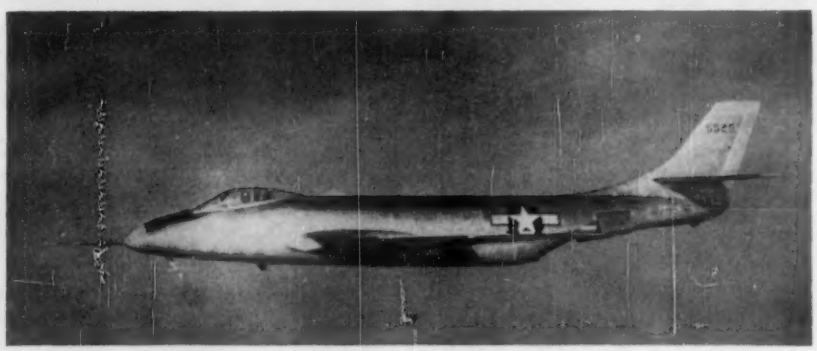
▶**Research Section**—Bell is doing a large amount of fundamental research in areas of possible application to rocket motor technology. About two-thirds of the work of the research section, under Thomas Reinhardt, is applicable to specific projects; the remaining one-third is on independent contract.

Research section is divided into three groups: materials and propellants, heat transfer and fluid mechanics, and combustion.

Typical of the work of the section is an investigation of heat transfer by electrical analogy. A specially prepared paper with surface conductivity is used, and voltages are applied at points simulating transfer into a sheet of metal. Voltage distribution and drop can be measured, and with analogy, heat transfer data can be obtained.

Some work is going on in the investigation of the fluid mechanics of fuel and oxidizer droplets; Bell scientists believe that if they know the mechanics of fuel-oxidizer mixing and combustion,





McDonnell's New F-101A—And How It Grew

Comparison of McDonnell Aircraft Corp.'s new F-101A Voodoo (top) with the XF-88 Voodoo, from which it was developed, shows some of the major external engineering changes in the two jets, notably in the tail section and engine installation. Not so readily apparent is the stretch in fuselage: The F-101A is 67.4 ft. long, compared with the XF-88's approximate 55 ft. Power has been greatly increased, the XF-88A having two 4,000-lb.-thrust Westinghouse J34s, while the latest Voodoo has two 10,000-lb.-thrust-class P&W J57s. The XF-88A, which first flew in 1948, was an entry in an Air Force longrange penetration-class fighter competition for which the Lockheed XF-90 and North American YF-93A also were built. The project was canceled. McDonnell has more than $100 million in orders for the new atomic-weapon carrying F-101A and RF-101A, to be used by SAC (Aviation Week Nov. 29, p. 14 and p. 16).

they will be able eventually to shorten the combustion chamber of a rocket motor.

Currently, the quantity of rocket engineering personnel at Bell has leveled off at a little more than 600. Working under Smith are 177 engineers, 68 designers, 315 technicians and 61 in supporting services.

▶ **Where To?**—Smith said that the real future for rocket development lies in intercontinental and satellite vehicles, and that Bell has done more than just think about these future applications.

The company's rocket effort already has attracted some attention because of the successful operation of their engines in various missiles.

Their future growth in the rocket powerplant field seems assured, and will undoubtedly be built on the strong foundation of 10 years' experience with a variety of rocket propellant combinations, including alcohol-oxygen, hydrogen peroxide-hydrazine, chlorine trifluoride-hydrazine, and acid-JP-4.

THRUST & DRAG

Once in a great while, an aviation book comes along that is must reading for every enthusiast, for every engineer, for every pilot who flew in World War II. Such a book is Hans Mueller's "First and Last I Flew for the Fueher Because Flying is My Life."

Mueller is best remembered as the famed "Rotenase Rauser von Rothenburg," leader of Rotenase Jagdstaffel Drei. Terror of the B-17 formations, Mueller more than once found himself flying wing man to Eighth Air Force bombers. His knowledge of USAAF flying techniques developed his careful use of evasive tactics and accounted for his survival of the air war.

Mueller was that strange phenomenon, a Luftwaffe pilot who was a Nazi, who believed that the Russians and the Allies were equally determined to beat the Germans, and who was frequently afraid of his opposition. Through the entire war, he flew no special missions for the Fuehrer. He was never called to Adlershof or Berchtesgaden to advise on the progress of the war; in fact, it is doubtful that Hitler knew Mueller from a hole in his headquarters.

Mueller was decorated only twice, both times by a general order which decorated everybody else in the Luftwaffe with the Knight's Cross of the Iron Cross, Second Class, with Swords, Diamonds and Crossed Knackwursts.

Orders were obeyed by Mueller, but sometimes he questioned them. There were times when he suspected that maybe his wing commander was slipping a cable, but he never questioned the ability of Herrmann Goering. In fact, he rather liked the fat boy, and envied his position, his wealth, his chateaus, his cellars.

By and large, Mueller was satisfied with the aircraft he had to fly. He thought the Me-109 wasn't a bad airplane, and when somebody asked him if he'd like a squadron of Spitfires to fight with, he turned it down, saying something about maintenance being a bit difficult under the circumstances.

When the fall of Berlin seemed imminent, and Goetterdammerung was being played in the wings, Mueller was stationed at an airbase near the German capital. Having no wish to die with Hitler, and not caring whether he saw him again (remember that they had never been formally introduced) Mueller climbed into his plane and took off for parts unknown, a little village in the Bavarian Alps near Garmischpartsunknown.

Here in idyllic surroundings, he was on the point of starving to death when he wrote and successfully sold his memoirs. The thoughts that motivated him in his long journey through the torments of war and the triumphs of flight are best expressed in Mueller's own words:

"What the hell, it's just another job."—DAA

HARTWELL

. . . Symbol of Service to the Aircraft Industry

TYPICAL EXAMPLES OF HARTWELL FLUSH LATCH DEVELOPMENTS

The familiar name that identifies each flush latch and hinge built by HARTWELL is more than a mere trademark.

To us this one word—HARTWELL on our product symbolizes a challenge—a challenge to continue building our products to the highest standards of quality and performance required by the aircraft industry.

To you it means sound design, rugged construction, and ample safety factor for long life and dependability—all the things you want in this type of equipment.

Manufacturers of Aircraft Flush Latches and Hinges, Fittings and Cable Terminals. New 72 page, 2-color Catalog illustrates and gives full details of complete line.

MAIL COUPON

HARTWELL AVIATION SUPPLY COMPANY
9035 Venice Boulevard, Los Angeles 34, California
Send illustrated Catalog
NAME_____
COMPANY_____
ADDRESS_____
CITY_____ ZONE_____ STATE_____

HARTWELL
AVIATION SUPPLY CO.
9035 Venice Boulevard
Los Angeles 34, California
Branch Office: Wichita, Kansas

TYPE R-149

EEMCO's unique Type R-149 linear actuator is entirely self-contained; the motor, clutch, planetary reduction gear and limit switch are all enclosed within the smaller inner cylinder. Type R-149 has an unusually long stroke of 9.625" at .3" per second under a normal load of 4000 lbs. on a 28 volt DC system. Maximum operating load is 8000 lbs., maximum static load, 15,000 lbs. EEMCO's compact Type R-149 has adjustable load limit switches, non-jamming end stops, and a motor that shuts off automatically when end stops are reached, or load exceeds a pre-set limit. Weight is 10 lbs., 5 oz.

Need Special LINEAR ACTUATORS?

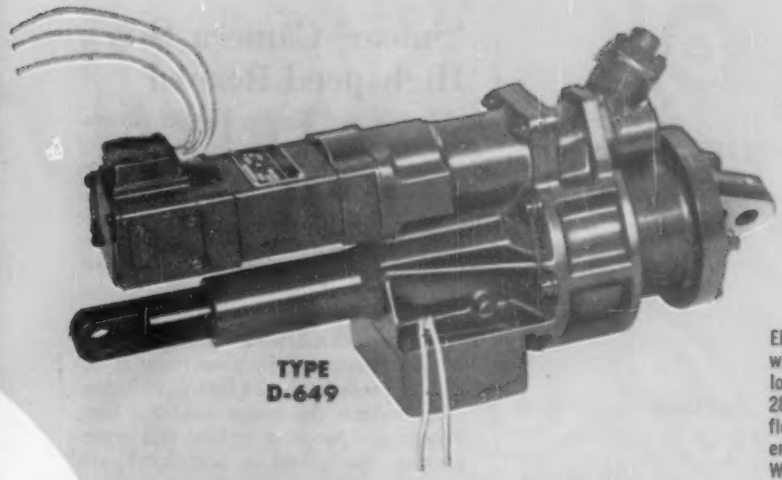
EEMCO can save you valuable development time and expense and speed the delivery of actuators by altering one of its many tested and proven linear models to fit your specific need.

Shown here are a few of many EEMCO self-powered and remote-controlled mechanical linear actuators that have been designed, developed, tested and produced for various air frame manufacturers. There is a definite possibility that one of the actuators illustrated (or others not shown) can be adapted to <u>your</u> specific need as to load, length of stroke, rate of travel, or other characteristic.

Illustrated at right is a group of EEMCO actuators designed for aileron, elevator and trim tab controls. Powered by the EEMCO Universal Power Package they can be operated singly or in groups to actuate systems — a cowl flap for example. These and many other custom designed EEMCO linear actuators can be adapted for specific purposes with a minimum of expense and delivery time.

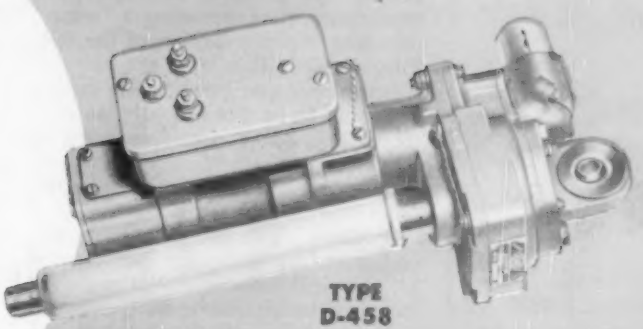
EEMCO's flexible Universal Power Package drives single or multiple screw jack actuators, either rotary or linear (some of which are illustrated at right), with direct or flexible shaft connection for remote operation. This compact 3⅛ lb. power package is only 7⅛" x 4⅞" x 2¾" in size yet contains motor, radio noise filter, magnetic clutch and brake, reduction gear and auxiliary gears operating adjustable limit switches to control travel, light switches and position indicator. Specifications can be changed to suit special requirements.

FLEXIBLE UNIVERSAL POWER PACKAGE



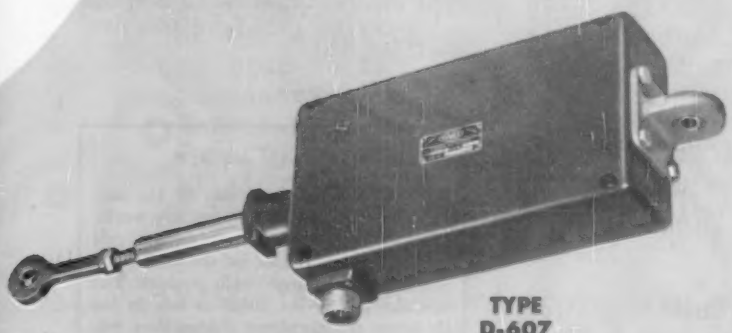
TYPE
D-649

EEMCO's Type D-649 linear actuator weighs 13.75 lbs., and operates with a stroke of 3 5/16" at .55 inch per second under a working load of 3400 lbs. normal tension and 8200 lbs. peak tension on a 28 volt DC system. Maximum static load is 18,750 lbs. It has a flexible shaft drive take-off, load limit switches, non-jamming end stops and a retraction stop that adjusts to within ¼ inch. With minimum expense and delivery time EEMCO's Type D-649 can be supplied for various loads, lengths of stroke, rates of travel and other characteristics.



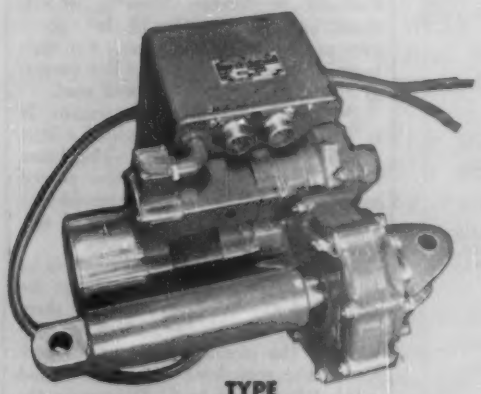
TYPE
D-458

EEMCO's Type D-458 linear actuator for jet wing flaps weighs 8 lbs., 3 oz., has a stroke of 5.14" at .4" per second on 28 volt DC system under a normal load of 3000 lbs. Ultimate static load is 10,000 lbs. compression in fully extended position. Type D-458 has non-jamming end stops, provision for power take-off or hand drive (right angle) and radio noise filter. Load, stroke, rate of travel and other features of EEMCO's Type D-458 can be changed to suit specific needs in a minimum of time.



TYPE
D-607

EEMCO's Type D-607 is a door actuator for transport aircraft which weighs 4.5 lbs. and has a stroke of 6.25 inches. Linear rate of travel is .33" per second at the rated load of 450 lbs. compression. Ultimate static tension load is 7000 lbs. EEMCO's Type D-607 has non-jamming end stops, adjustable travel-limit switches, radio noise filter and operates on a 28 volt DC system.



TYPE
R-129

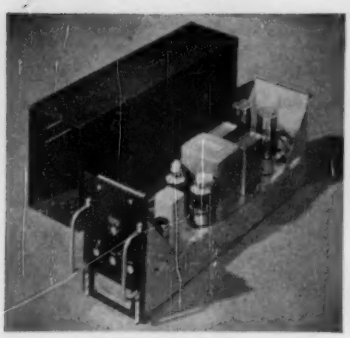
EEMCO's Type R-129 is a stabilizer actuator for large jet fighters. It is a complete actuator assembly incorporating two motors, 1/10 hp and 3.3 hp, operating through gear reductions to give a drive rate of 6/100" per second and 7/10" per second respectively to the screw jack. Normal operating load is 11,000 lbs.; static load is 80,000 lbs. The small motor operates almost continuously with automatic pilot, while the larger motor provides for manual pilot control at a higher rate of maneuvering. Type R-129 operates on a 28 volt DC system, has overload and limit switches, radio noise filter, position indicator, non-jamming stops. Weight, 45 lbs.

Designers and producers of
motors, linear and rotary actuators.

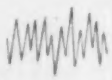
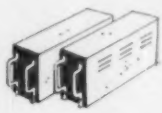
Electrical Engineering and Manufacturing Corp.

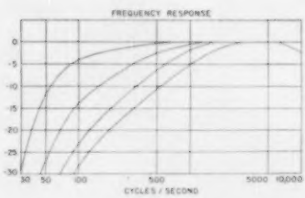
4612 West Jefferson Boulevard
Los Angeles 16, California

EEMCO can supply a linear actuator to fit *your* specifications



NEW REMLER
AIRCRAFT AMPLIFIER
Model A550

Alley cats find their way in the dark but people need to see and aircraft passengers need an adequate volume of noise-free  sound for good h- ing. Remler A550 has power of  existing amplifiers . . . delivers 40 watts of audio power into a 70 volt line.



Variable low frequency roll-off assures maximum intelligibility for voice announcements. Automatically cuts

for music. 70 volt line permits great flexibility in number and location of s and adjustment of individual speaker volume to noisy locations.

Interchangeable . . . dimensions are identical with existing amplifiers. Outputs available for current installations.

Remler recommends full coverage with up to 50 small speakers,

for descriptive specifications of complete systems, write—

Remler Company

2101 Bryant Street • San Francisco 10, California • VAlencia 4-3435
Washington, D. C.: Wyatt Building

'Smear' Camera Gives Highspeed Record

A new tool for the research laboratory studying the progressive action of explosives, shock waves, spark-discharges or tube flashing, is an ultra-highspeed camera system recording time space data at a sweep speed of 5.46 mm. per microsecond, with duration of 44 microseconds.

Schlieren interferometric effects may also be captured with the equipment. A mirror rotating in a vacuum at selected speeds in the 24,000-50,000-rpm. range reflects the image onto the film, sweeping it across a vertical axis representing space and a horizontal axis representing time, providing a "smear" recording of the transition of the test. Film size is 4x10 in.

Synchronization between the camera and event to be recorded is by an electronic measuring unit producing a sharp, positive output pulse of approximately 250-v. peak used for firing the event.

Auxiliary features include a secondary output pulse that can be used as an oscilloscope sweep trigger for recording transit-time measurements.

Manufacturer of the synchronized streak camera (Model 168) is Beckman & Whitley, Inc., 985 San Carlos Ave., San Carlos, Calif.

BUT STILL WE FLY

An airplane crash is one of the outstanding tragedies of this modern world. Most of us, at one time or another, ride in airplanes. Many of us, without much concern, make transoceanic passages. The statistics say we are about as safe in the air as we are anywhere. More than two and a quarter million passengers pass through Idlewild Airport every year. Casualties in six years, down to last Saturday, had taken the lives of six or seven persons, passengers and crew. For each hour of exposure we are safer in a passenger plane than on a high-speed road.

But the shock and the pity remain. It is hard, for example, to think of a little girl, just before Christmas, coming home for a happy holiday—and then carried ashore, dead, off the end of a smoldering pier on Jamaica Bay. These deaths sadden us all.

But no airplane crash will dissuade us from taking to the air whenever we are in a hurry—or perhaps for the sheer pleasure of riding like gods above the level of the plodding and earth-bound. One plane goes down but ten thousand safely take off and land. We mourn the dead we never knew, but we settle in our seats, read our newspapers and see, above the clouds, the glories of sunset and dawn.

Editorial, New York Times, Oct. 20

The 1,000th C-119 Flying Boxcar rolled off the Fairchild production line at Hagerstown, Md.,

AVIATION WEEK

THE MAGAZINE OF AVIATION BUSINESS

ROBERT W. MARTIN, Jr. PUBLISHER

A McGRAW-HILL PUBLICATION
330 WEST 42ND ST., NEW YORK 36, N.Y.

MEMORANDUM TO THE AVIATION INDUSTRY

On March 14, 1955, AVIATION WEEK will publish "Airpower in the Age of Peril," the 22nd Annual "Inventory of Airpower" Edition. In this annual number which has gained world-wide readership, AVIATION WEEK editors will report on the story of the Aviation Industry's transition from the Korean crisis buildup to the solid Industrial and Military Airpower base necessary to meet the growing requirements of the new U. S. Defense Policy. "Air Power in the Age of Peril" is of vital importance to all those Aviation Management Men, Engineers, Military and Government Officials whose efforts and interests are devoted to the expansion of civil and military aviation and the defense of our country.

Editorial assignments have been made to 17 AVIATION WEEK editors for special reports and articles. Traveling schedules are presently in force and a voluminous amount of material is now in the process of collection. In all, this outstanding issue will add to the record of usefulness of previous editions and establish new standards of factual presentation and reporting.

For advertisers, the 22nd Annual "Inventory of Airpower" Edition offers 1955's most appropriate spot for your sales message. I heartily recommend its use to all Aviation Manufacturing Companies and Suppliers as an outstanding 1955 editorial presentation.

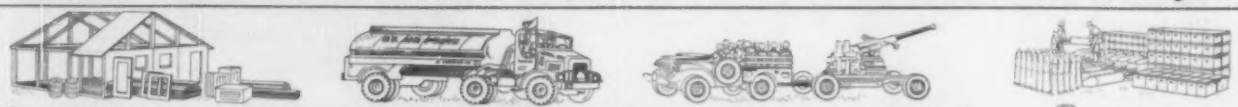
Sincerely,

Robert W. Martin, Jr.

The 1,000th C-119 Flying Boxcar rolled off the Fairchild production line at Hagerstown, Md.,

***on schedule,* and was accepted by the U. S. Air Force. Fairchild is proud of the pilots, crews and**

maintenance teams who have made the Flying Boxcar famous the world over as a depend-



able workhorse, giving increased flexibility to our Armed Forces—a symbol of American

production ingenuity and design efficiency. Proud,

too, of the thousands of Fairchild men and women whose

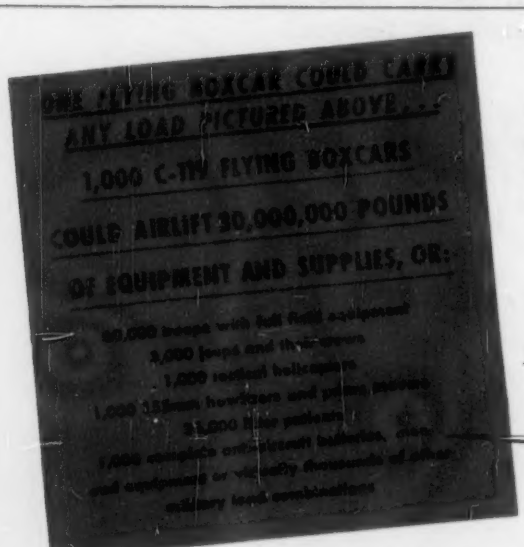
combined skills have made this production record possible.

... Proven in combat and in peace, proven in tropic and arctic opera-

tions, this great world-wide team of C-119 Flying Boxcars is now joined by its 1,000th member,

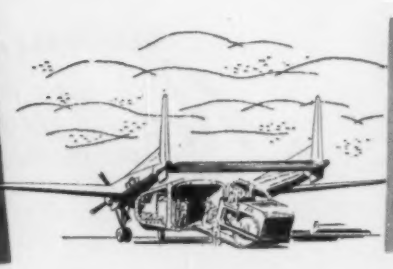
as together they reach new heights as an indispensable part of America's flexible armed forces.

JUST DELIVERED THE 1000th FLYING BOXCAR


ONE FLYING BOXCAR COULD CARRY
ANY LOAD PICTURED ABOVE...
1,000 C-119 FLYING BOXCARS
COULD AIRLIFT 30,000,000 POUNDS
OF EQUIPMENT AND SUPPLIES, OR:

Typical of the many vital jobs assigned to Flying Boxcars is the Air Logistics Service, established by the United States Air Force in Europe. Because of the Flying Boxcars' military flexibility and dependability, daily scheduled cargo flights are being made possible. A service was inaugurated, and is now in operation, which assures regular delivery of approximately 4,000 tons a month of vital military supplies and equipment at tremendous savings to our government.

Enlist to Fly in The U. S. Air Force



ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
HAGERSTOWN, MARYLAND

"where the future is measured in light-years"

Other Divisions: American Helicopter Division, Manhattan Beach, Calif.; Engine Division, Farmingdale, N. Y.; Guided Missiles Division, Wyandanch, N. Y.; Kinetics Division, New York, N. Y.; Speed Control Division, St. Augustine, Fla.; Stratos Division, Bay Shore, N. Y.

Esna Official Tells . . .

What's Delaying Titanium Fastener Use

• Wide application of the metal in locknuts waits on advances in metallurgy and manufacturing techniques.

Titanium and is alloys someday will play a big part in aircraft nuts and bolts, as they will in structural components of aircraft. But for some of the hardware the transition will have to be gradual, according to James Duke, product planning manager of Elastic Stop Nut Corp. of America.

Esna is producing prototype titanium alloy locknuts for evaluation programs, Duke says, but wholesale use of these locknuts is well in the future, he believes.

▶Bolts First—Acceptable titanium alloy bolts will come first, according to Duke, who indicates that aluminum and stainless steel nuts can be used with these bolts to provide substantial weight savings at reasonable cost. Titanium locknuts will take over when metallurgical development, availability and revised manufacturing methods warrant the switch.

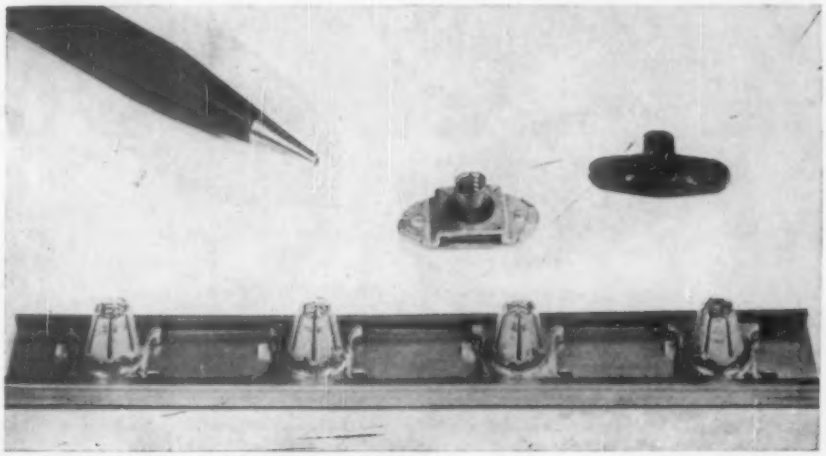
Duke outlined his views before the recent first National Symposium for Titanium Standard Parts, sponsored by the National Aircraft Standards Committee of the Aircraft Industries Assn.

▶Weight Cuts, but When?—Since fasteners are used in large quantities in every type of aircraft, weight savings of the order of 500 to 2,000 lb. per plane can be achieved by substitution of titanium for steel fasteners, Duke claims.

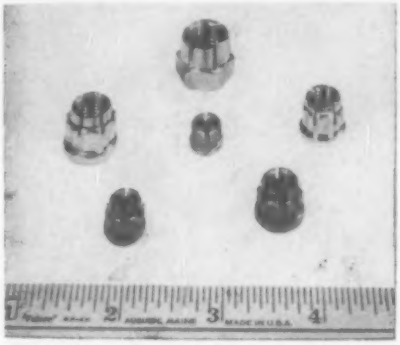
"But," he asks, "how and when will we reach a point where satisfactory titanium (alloy) parts are available in quantity?"

Esna's program is now more than four years old. It has been concerned mainly with research aimed at determining the basic qualities of titanium alloys for threaded fasteners, and at developing general production techniques for processing the alloys "as we know them today," Duke says.

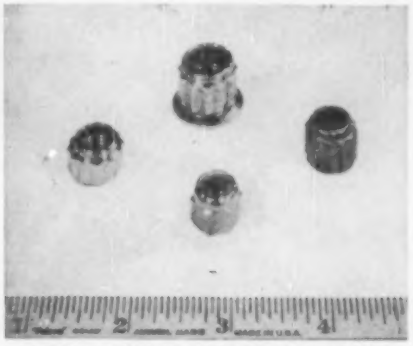
The company's research so far has resulted in the production of titanium alloy locknuts to AN specifications in experimental prototype forms, in quantities which permit customer evaluation programs. Esna is producing fixed and non-fixed self-locking nuts of the elastic insert type, the deflected beam type, and the elastic membrane type.



EXPERIMENTAL ESNA FIXED LOCKNUTS—Anchor (top r.) and floating anchor nuts (center) have titanium alloy bodies, respectively fused to pure titanium base and retained in steel "basket"; bottom, silver-plated stainless steel beam-type nuts in titanium channel.



NON-FIXED all-metal beam-type locknuts made of titanium alloy have threaded collar slotted to form elastic beams.



ELASTIC INSERT experimental titanium alloy locknuts made by Esna. The elastic inserts in these nuts are made of nylon.

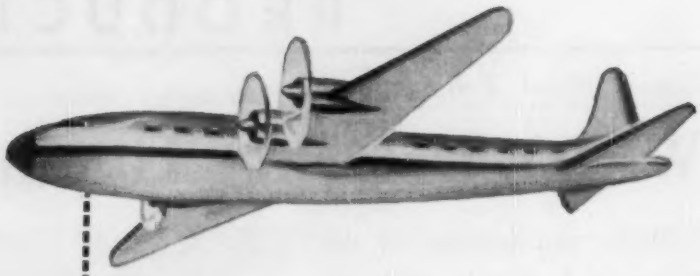
▶Some Findings—At the time the program started there were only two or three titanium alloys available, and these were in a very early stage of developments. Esna was looking for a yield strength greater than 125,000 psi., and sufficient ductility to permit the torque setting operation for insert or beam-type configurations. Of the materials studied, the RC-130B alloy came closest to Esna's requirements. However it has limitations, particularly from the manufacturing standpoint, Duke claims. He adds:

"In early stages of our program results were inconsistent, due to variations in the material received. To a certain degree this is still an important factor. We have observed age cracking, reduced fatigue strength, variations in hardness, and lack of homogeneity of material, in practically every lot of prototype nuts we have made.

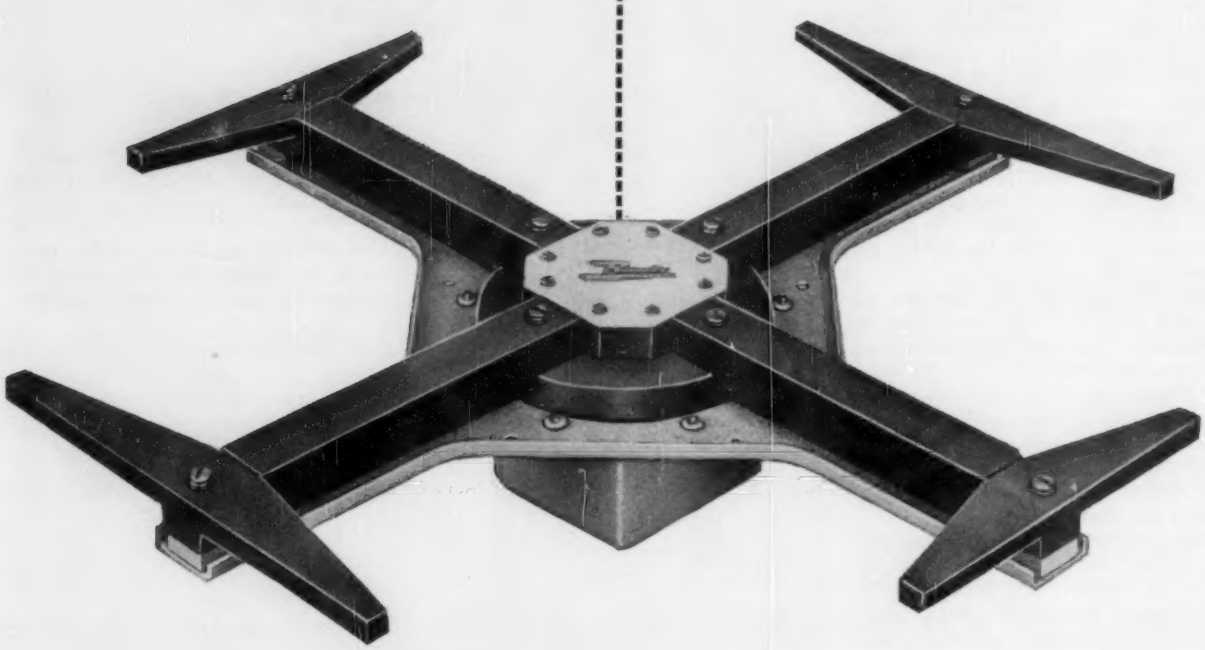
"We also find creep unpredictable. . . . Work we have done at room and elevated temperatures shows more study is required to develop creep characteristics before we can be assured of completely reliable fasteners. Relaxation curves are more desirable.

It has been observed that titanium accelerates the corrosion of less-noble metals in composite fastenings and construction. This ought to be carefully studied by the aircraft industry, since it is presumed titanium bolts and nuts will be used to fasten aluminum as well as titanium and stainless steel structure.

▶Attack on Galling—"We have ob-



THE Bendix FLUSH ADF LOOP ANTENNA



It's the newest automatic radio compass for high speed aircraft. It's the new Bendix* LPA-70A ADF antenna that is flush mounted, completely eliminating drag.

Designed to be usable with present MN-62 compass or the future DFA-70, it provides equal or greater sensitivity than present day loops.

Recessed mounting of the Antenna reduces precipitation static because there are no projections . . . no exposed areas.

Location of the Bendix Flush ADF Loop Antenna may be either on the top or lower surface of any aircraft.

Now in production. Write to Bendix Radio, Baltimore 4, Maryland.

THE NAME Bendix AVIATION CORPORATION MILLIONS TRUST

* Reg. U. S. Pat. Off.

Bendix Radio

DIVISION OF BENDIX AVIATION CORPORATION • BALTIMORE 4, MARYLAND

Export Sales: Bendix International Division, 205 E. 42 St., N. Y. 17, N. Y., U. S. A. West Coast Sales: 10500 Magnolia Blvd., North Hollywood, California.
Canadian Distributor: Aviation Electric, Ltd., 200 Laurentian Blvd., Montreal, Que.

served large variations in the thread form and over-all performance of titanium (alloy) bolts from various sources, although there has been a notable improvement in these characteristics lately," Duke says. "Bolt variations have a big influence on self-locking nut performance, and the effects are exaggerated in the case of titanium fasteners since galling and re-use characteristics are a direct function of the fit and finish of mating parts."

Esna has done considerable study of the galling problem. With American Chemical Paint Co., it engaged in an extensive program to develop an effective and permanent lubricant, which is a development by American of their L-698 lubricant for threaded titanium parts. This is similar to a phosphate stearate lubricant, and is permanent even when exposed to elevated temperatures.

Use of this lubricant permits re-use of titanium alloy locknuts in accordance with applicable AN specifications, and smooths out the torque-tension relationships for fasteners employing titanium parts.

▶ **Manufacturing Problems**—There is a close relationship between the design of a self-locking nut and the fabrication problems associated with making this nut in volume. Hard tools with deep cuts under power are required for titanium alloy, resulting in a nut cycle time four times slower than that for steel.

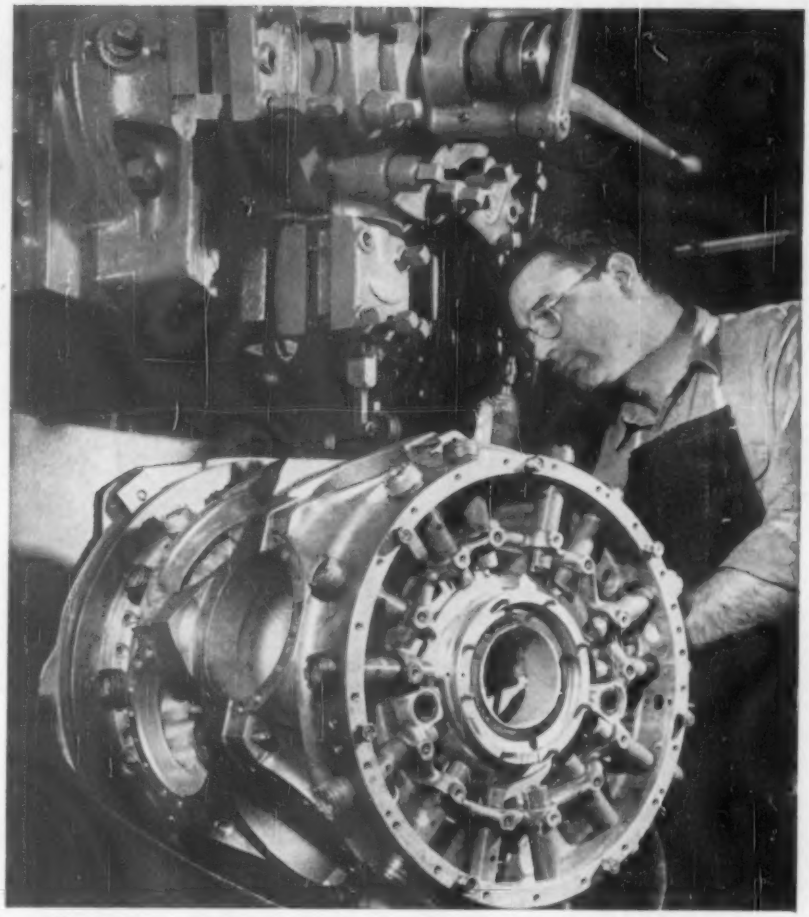
A good portion of the cost of a machined titanium alloy nut lies in the scrap material removed, and so far this scrap has little or no resale value. So it would be desirable to start with a forged and pierced nut blank which would require only finish-machining operations, Duke claims.

Such a program will require long and expensive development and, if successful, will mean expensive outlays for tools and equipment.

The manufacture of titanium alloy nuts from sheet metal also shows considerably promise as a means for reducing cost. Esna is beginning research in this field.

▶ **Heading Difficulty**—Designs for anchor nuts employing Esna's elastic membrane locking principle are all of the two-piece type. At the present time the company has not worked out techniques for heading anchor nuts from titanium bar or wire. This will be a long and costly program, Duke says, and fabrication now is on screw machines.

There does not appear to be much sense in processing a 1-in. round bar to produce a nut whose body is only ⅜ in. wide, though its lugs or riveting surfaces are 1 in. wide. The scrap loss would be more than 75%. As small a



Rematching a new center section to a crankcase, a highly specialized operation.

Factory Tools for Overhaul

ASSURE RESULTS OF
UNIFORM EXCELLENCE

Highly specialized work on Pratt & Whitney Aircraft engines, such as rematching a new crankcase section or rebarreling cylinders, must be done with special machine tools and factory methods. . . . The tools and methods at the Airport Department are assurance that major parts replacements are as excellent as when new, and are properly installed.

Complete Overhaul and Repair Service for
ENGINES and PROPELLERS

AIRPORT DEPARTMENT
Pratt & Whitney Aircraft
DIVISION OF UNITED AIRCRAFT CORPORATION
RENTSCHLER AIRPORT · EAST HARTFORD, CONNECTICUT

WHAT DO YOU NEED TO TAKE A TAILPIPE TEMPERATURE?

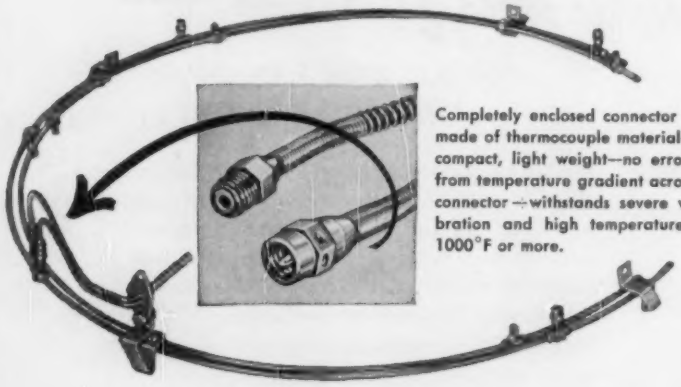
FOR ONE THING, A GOOD HARNESS.

It's tough to take the temperature of a jet's tailpipe. Severe vibration and extreme changes in temperature can wreck measuring equipment. Yet, the information is vital to men who build the engines and fly the planes.

The harness used for the job must be rugged enough to survive brutal operating conditions (even more brutal now that engine thrust and temperatures are being increased).

T-E has several solutions to the problem, and the rigid, ladder-type harness shown below is one of them. Extension wire is protected from the heat, corrosion, and abrasion by one-piece, stainless jackets which are lined with ceramic insulation. Positive and negative conductors are jacketed separately for compactness and ease of installation. Harness can be equipped with open-end or stagnation thermocouples.

Briefly, it's a well-made harness that can take lots of punishment and high temperatures.



Completely enclosed connector is made of thermocouple material—compact, light weight—no errors from temperature gradient across connector—withstands severe vibration and high temperatures, 1000°F or more.

Get in touch with us. Let us help solve your temperature-measuring problems.

Pyrometers • Thermocouples • Protection Tubes • Quick-Coupling Connectors
Thermocouple and Extension Wires • Resistance Bulbs • Connector Panels

Thermo Electric Co., Inc.

SADDLE RIVER TOWNSHIP, ROCHELLE PARK POST OFFICE, NEW JERSEY
IN CANADA—THERMO ELECTRIC (Canada) Ltd., BRAMPTON, ONTARIO

nut body as possible is machined from bar stock, and welded, brazed or mated with a commercially pure titanium sheet metal base.

Esna has had difficulty in fixing a titanium alloy nut body to a pure titanium nut base. The alloys with which it is working do not lend themselves readily to welding techniques, Duke says.

He sums up Esna's current position this way: "We can produce and are producing titanium alloy locknuts in small quantities for the much-needed in-service evaluation by the aircraft industry. There do not appear to be unsolvable problems connected with quantity manufacture by conventional means, but these practices result in undesirable costs because of scrap loss, slow machine cycles, and increased tool maintenance." Two major obstacles, he says, are availability and cost.

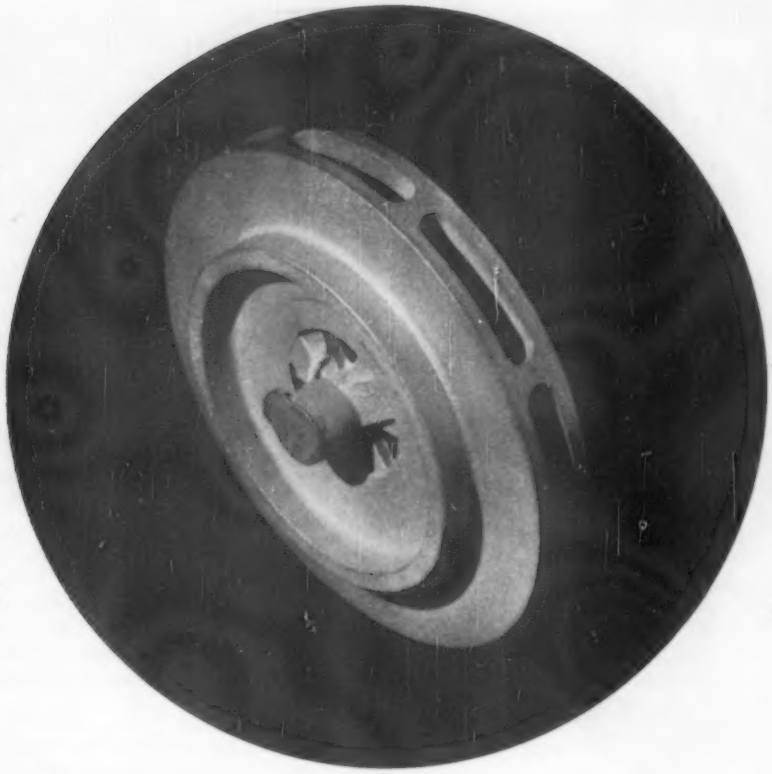
► **Cost of Savings**—Little more than a year ago it was estimated that Esna alone could use nine times the current annual output of titanium alloys, if it were to convert only part of its present steel line to titanium. This problem obviously puts large-scale weight savings from titanium alloy locknuts well into the future, Duke concludes.

In a given bolted connection approximately 75% the weight is due to the bolt, and 25% to the nut and washers. The nut is by far the more complicated member, hence more expensive to manufacture. It is also the portion of the fastener where the potential weight saving is least. So while it seems very desirable to change the bolt material from steel to titanium alloy, the economics of switching to titanium alloy nuts, under present conditions, needs further study, Duke maintains.

"For an illustration," he says, "consider the common No. 10 size steel hex nut. One million pieces of this nut weigh about 5,000 lb. If this one million pieces were converted directly to titanium, the weight would be about 3,000 lb.—a weight saving of 2,000 lb. The one million steel nuts would cost about $9,000, including a material cost of approximately $1,400.

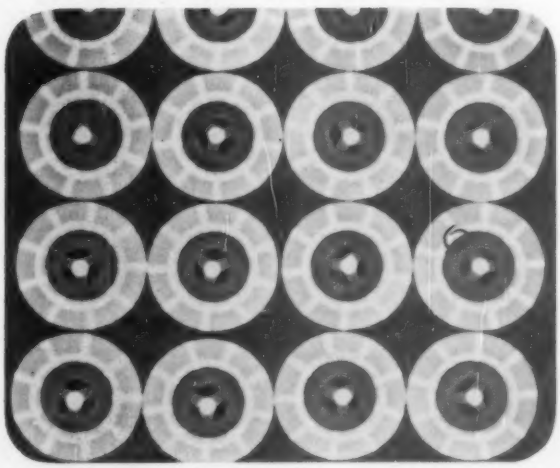
"The same million nuts in titanium would cost, for material alone, in excess of $160,000. . . . On material cost alone, we would be increasing cost by about $80 per pound of weight saved. This figure would be at least doubled by slower machine cycles and increased tool costs. . . . So we can estimate the weight savings would actually cost a minimum of $200 a pound.

"We find it hard to believe that such fantastic costs will be acceptable for production aircraft, and so again it would appear that quantity utilization of titanium (alloy) locknuts is in the future. We have said this must



SPINS LIKE "BLAZES"—

so Radiography checks each one



Radiograph of oil scavenger rotor in variable displacement pump for aircraft hydraulic systems.

"BLAZES" is not the word—but suggests the maker's shorter expression for the rate at which this rotor spins. Fact is, rpms are so high that the soundness of the casting is important in terms of safety as well as serviceability.

So radiography goes to work and plays its unique part. With no damage to the product, radiography looks inside the part and checks each rotor's structure. Only flawless parts will meet the strict requirements of service.

Proving soundness with x-rays has become common practice with more and more suppliers of quality castings. They know it helps build reputations for delivering only good work.

If you'd like details on how radiography can improve your operations, get in touch with your x-ray dealer—or write us for a free copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Radiography...

another important example of Photography at Work

Kodak
TRADE-MARK

A ROUGH RIDE FOR THE ELECTRONIC UNIT!

So DOELCAM makes sure it rides safely with NOPCO® LOCKFOAM

When you're building a guided missile, you have to find a way to protect from terrific vibration and shock the sensitive resistors, capacitors, vacuum tubes, and transistors that make up the electronic circuit—the "brains" of the giant projectile.

Let Doelcam Corporation, Boston, Mass., tell you why they choose Nopco Lockfoam for this important task. Says Doelcam: "The electronic parts, firmly bound in this light-weight plastic, withstand tests of vibration in 3 planes from 0 to 500 cycles per second at 10 G and shocks of 50 G. The advantages of Lockfoam in such electronic airborne applications are its light weight, inherent strength, and its ability to grip the electronic components firmly enough to protect them from vibration and shock and yet gently enough not to crush them."

Plus, of course, ease of assembly; the liquid Lockfoam is simply poured into a mold which contains the electronic circuit, and hardens around it.

Each of Lockfoam's 50 different formulations is highly consistent and reproducible. Perhaps the rare combination of properties of this versatile plastic can help with some product *you* have in mind. Write today for the Nopco Lockfoam booklet. Nopco Chemical Co., Plastics Division, 148 Stier St., Harrison, N. J.

NOPCO

California Office: 4858 Valley Blvd., Los Angeles 32

await greater availability of titanium alloys, and now we add that it must await development of better and less expensive alloys, a scrap recovery process, and faster production methods which produce less scrap."

►**Uses Proposed**—During the period when titanium alloy bolts are available at moderately high costs but titanium alloy nuts are not, high-strength aluminum and silver-plated stainless steel nuts are satisfactory substitutes.

For the lower-temperature applications it seems doubtful at this time whether titanium nuts will ever measure up to the weight saving potential of aluminum at comparable costs and strength levels.

Duke proposes consideration of weight-saving programs built around titanium bolts with aluminum and stainless steel nuts. The average bolt weight saving should be about 30%. For the lower temperatures, a high-strength aluminum nut should save 70%, or approximately another 20% of total fastener weight. This combination, therefore, would reduce weight about 50%, he says. In the high-temperature category, a combination of titanium bolt and 12-point stainless steel nut should give about a 40% weight saving.

A high strength aluminum nut is available capable of meeting the same tensile strength requirements as the steel or titanium nut it replaces. It weighs 1,900 lb. per million pieces—a saving of 3,100 lb.. compared to the No. 10 steel nut. While the cost per pound of weight saved with a titanium nut was found to be $200 minimum, with aluminum the cost of a greater weight saving would be 60 cents per pound, Duke points out.

"These aluminum nuts have demonstrated compatibility with titanium bolts," he says. "They have already been used with titanium bolts by three major airframe manufacturers, and one of these has gathered considerable production assembly experience. Naturally this combination is restricted to structural applications where temperature is not a serious factor. This includes between 90 and 95% of all fastening applications in current and projected man-carrying aircraft."

These aluminum nuts, meeting AN specifications for steel nuts of the same thread size, are made in sizes up to ¼ in. Above this size, Esna suggests aluminum nuts with an ultimate strength of 90,000 psi. instead of the 140,000 psi. required of equivalent steel nuts. "We believe the 90,000-psi. figure to be entirely satisfactory for the shear applications which comprise 90 to 95% of all airframe bolted connections," Duke says.

For high-temperature applications and where the joint is in tension, he says, a weight decrease from present practice can be obtained through use of 12-point nuts. These would be silver-plated stainless steel parts, compatible with titanium bolts since the plating appears to be sufficiently durable to prevent plating buildup and galling on the bolt or nut threads. A weight saving of 40% can be obtained through the combination of titanium bolts and silver-plated stainless steel 12-point locknuts, as compared to steel bolts with steel hex nuts.

"Our own and aircraft industry tests show these aluminum and stainless nut types to have satisfactory torque-tension relationships when used with titanium bolts," Duke concludes. —IS

Air Force Honors Small Business Chief

Kennard Weddell, chief of the Air Force Office of Small Business (center) receives a commendation for outstanding performance in conducting that service's program of bringing small firms into the defense picture. Presenting the commendation is Brig. Gen. T. P. Gerrity, Air Force director of procurement and production engineering (right). Watching presentation, Lt. Gen. B. L. Boatner, deputy chief of staff, materiel.

GYROMECHANISMS

MINIATURE PRECISION POTENTIOMETER

Shown 1.3x actual size

This extremely low torque potentiometer employs unique techniques which permit a degree of accuracy in both linear and non-linear functions not normally encountered in miniature potentiometers. The noble metals selected for resistance winding and wipers provide low contact resistance and noise level and have an extremely long service life.

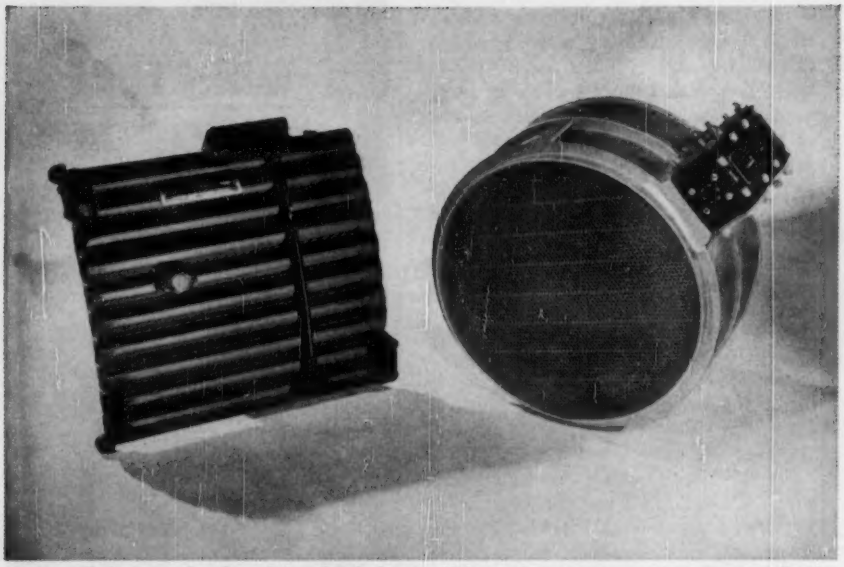
SPECIFICATIONS, MODEL 36,000:
⅞" O. D.

Resistance range: linear: 200 to 50,000 ohms in precious metals; up to 100,000 ohms in other metals.
other functions: vary with customer requirements.
Accuracy: linear: ± 0.1%
other functions: 0.25% typical for sine function.
Resolution: linear: up to .034% dependent upon resistance and function.
Rotation: mechanical: continuous.
electrical: 350° max. (360° continuous precious metal wiping surface).
Torque: starting: .05 in. oz. for 1 gang; .03 in. oz. for each additional.
running: .035 in. oz. for 1 gang; .02 in. oz. for each additional.
Weight: 1.0 oz. for 1 gang; .25 oz. for each additional.
Environmental conditions: temperature: −50°C to +90°C. This potentiometer is particularly well suited to operate at elevated temp. due to a unique heat dissipating design.
life: 1 x 10^6 operating cycles
shock: 60G
vibration: 10G to 500 cps.

Gyromechanisms' engineering specialists are available for consultation on research projects, without obligation.

GYROMECHANISMS, INC.
Halesite, Long Island, New York
11941 Wilshire Blvd., Los Angeles 25, California

Designers and producers of precision potentiometers, gyros for all purposes, and magnetic amplifiers.



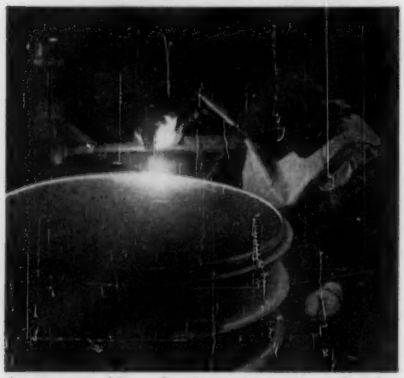
Modern all-aluminum oil coolers of the oil-to-fuel type (left) and the oil-to-air type (right) employ all-brazed construction for maximum strength-weight ratio and highest resistance to temperature, pressure, vibration and wear.

Progress In Oil Coolers . . .

Based on unique, proprietary processes for producing and brazing thin metal sections, plus the largest wind tunnel laboratory facility of its kind, the Clifford Company has pioneered the major developments in this field since 1940.

As flight conditions become increasingly severe with the drive for higher speeds over greater altitude ranges, temperature regulation of engine lubricating oil becomes a critical, sometimes limiting, factor in aircraft capabilities.

The relatively simple requirements of oil cooling in pre-war reciprocating engines, have today become complex heat exchange problems further complicated by the need to provide adequate heat rejection capacity within strict limits of size, weight — and sometimes even shape.



Inert gas welding of reciprocating engine oil cooler.

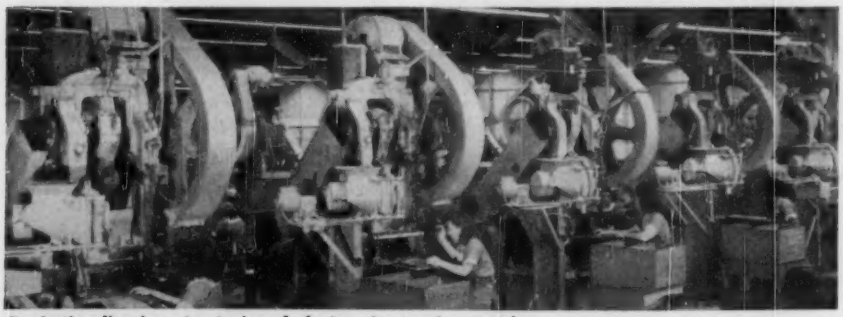
Three unique assets Clifford brings to bear on aircraft heat exchange problems have been largely responsible for the fact that it has initiated the major advances in the oil cooler field since 1940.

One asset is Clifford's ability to produce and fabricate thin metal sections, based on its own developments in deep drawing and extrusion.

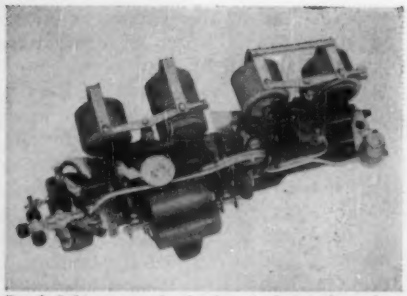
Another is its exclusive proprietary process for brazing thin metals — particularly aluminum — which is unmatched by any other process.

Third is Clifford's wind tunnel laboratory — the largest, most completely equipped technical facility of its kind.

Clifford's background since the company's inception in 1926 was in the manufacture of thin walled metallic bellows and thermostatic assemblies.



Production line impact extrusion of aluminum heat exchanger tubes.



Bombsight servomechanism is typical aircraft application of Clifford bellows for automatic compensation of changes in temperature, pressure and other factors.

Typically, it broke into this field by developing the new, superior hydraulic forming method of producing bellows which today is the standard process throughout the world.

Handling thin metal sections to produce products for the control of heat proved excellent basic experience to back up Clifford's entry into the aircraft field.

The deep drawing and extrusion process attracted the attention of the armed services in the pre-war preparedness days and Clifford was asked to produce copper tubes for the manufacturers of aircraft oil coolers and coolant radiators.

Once acquainted with the field, it was not long before Clifford's metallurgical background uncovered an area of opportunity. Copper coolers were not wholly satisfactory. The dip soldering method of fastening the tubes so annealed the metal that many failures were experienced at pressures of only 100 psi or less. With oil pressures trending steadily upward in the newer engines, the situation was right for the introduction of a better design if one could be found.

Five years of metallurgical research at Clifford had resulted in a unique, proprietary process for brazing thin aluminum sections. Combining its earlier development in deep drawing and extrusion of thin tubing, Clifford independently designed and produced the first all-aluminum oil cooler and coolant radiator.

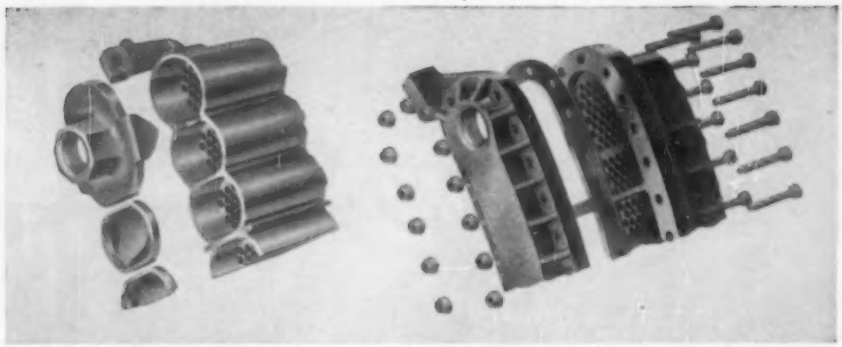
The new unit weighed only one-third as much as conventional copper coolers and life cycle tests showed a far higher service expectancy. The air services gave their enthusiastic approval and Clifford found itself in the forefront of a new field.

First to use the new aluminum oil coolers and coolant radiators were the Air Force's P-40 and P-38. Others quickly followed. At the war's end, Clifford was the sole producer of all-aluminum oil coolers whose products had been combat tested.

Lockheed's famous P-38 was among the first military aircraft to use Clifford's newly developed all-aluminum oil coolers and coolant radiators.

Advertisement

Coolant radiator of the type used in wartime liquid-cooled reciprocating engines.



Advanced, simplified design of liquid type oil cooler for jet engines (left) shows obvious advantages over original design pioneered by Clifford. Gaskets, bolts and nuts are eliminated, weight reduced 28%, and a stronger, unitized, all-brazed construction achieved.

Early jet engines coming along after the war required no oil cooling device. Oil was simply sprayed on the bearings and then ejected overboard. But with General Electric's contract to produce the J47-C, Clifford was asked to develop a suitable cooling system.

A completely new concept of oil cooling was suggested by Clifford. Since jets consumed large amounts of fuel it was possible to pass cold fuel on one side of the heat exchanger, hot lubricant on the other. With the flow governed by thermostatic valves, the lubricating oil is kept at optimum temperature.

The new design, since it did not depend on ram air for cooling, could be mounted out of the air stream and more easily armored. These and other advantages caused it to be adopted as standard for military jet aircraft.

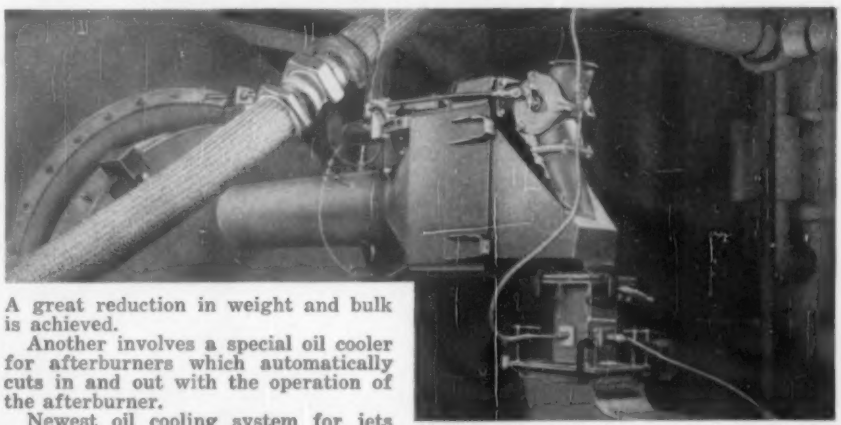
Later improvements resulted in substantial weight reduction and the elimination of numerous parts. Employing an extruded aluminum shell fastened by its proprietary brazing process, Clifford is today the only company able to produce these superior all-brazed, all-aluminum oil coolers.

Clifford's wind tunnel laboratory plays an increasingly important role in keeping the company in the forefront of aircraft heat exchanger developments. Ability to simulate service conditions with great accuracy eliminates the need for time consuming, expensive field testing of new designs. Its vast store of empirical knowledge permits rapid translation of thermodynamic theory into practical design without need for a succession of pilot models.

In few companies is there such a direct linear connection between research and production as can be found at Clifford.

New developments, still under military or proprietary wraps include a new oil cooler design based on using the latent heat of vaporization to cool the oil and vaporize part of the fuel before it enters the combustion chamber.

Sikorsky's H-39 helicopter which recently established a world's speed record, carries a Clifford oil cooler.



Wind tunnel test of air-to-air type heat exchanger assembly. Unit shown has integrally mounted control valves and actuator, and is used in aircraft air conditioning systems.

A great reduction in weight and bulk is achieved.

Another involves a special oil cooler for afterburners which automatically cuts in and out with the operation of the afterburner.

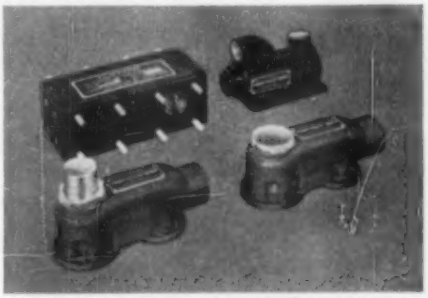
Newest oil cooling system for jets takes care of "high altitude cooling" conditions. When fuel flow drops too low to provide adequate cooling, thermostatic valves cut in an auxiliary air type cooler.

Helicopters pose especially difficult problems. Changes in direction from horizontal to vertical flight — or to hovering — makes their oil cooling demands highly variable. Clifford is currently developing two answers to these problems. One is an air-type cooler placed in an eductor. Engine exhaust is used to induce a flow of air for cooling. The second employs an air-type cooler placed in the air stream, but having in integral fan driven by a fluid motor. Oil temperature determines the operation of the fan through the action of thermostatic valves.

Rockets, missiles and avionic equipment are other areas in which Clifford is working. The company is also deep into nuclear energy heat exchange involving the handling of molten metals.

In all these areas, Clifford's unmatched facilities in aircraft heat exchange; and its unique ability to produce, fabricate and braze thin metal sections by proprietary processes is largely responsible for its present leadership in aircraft heat exchanger design.

For further information write: Clifford Manufacturing Company, 175 Ipswich St., Boston 15, Mass. *Division of Standard Thomson Corporation.* Offices in New York, Detroit, Chicago, Los Angeles and Waltham, Mass.



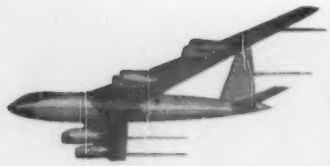
Self contained oil temperature regulating valves are designed and manufactured by Clifford for oil cooler applications.

Installation of oil-to-fuel type oil cooler on turbo-jet engine.

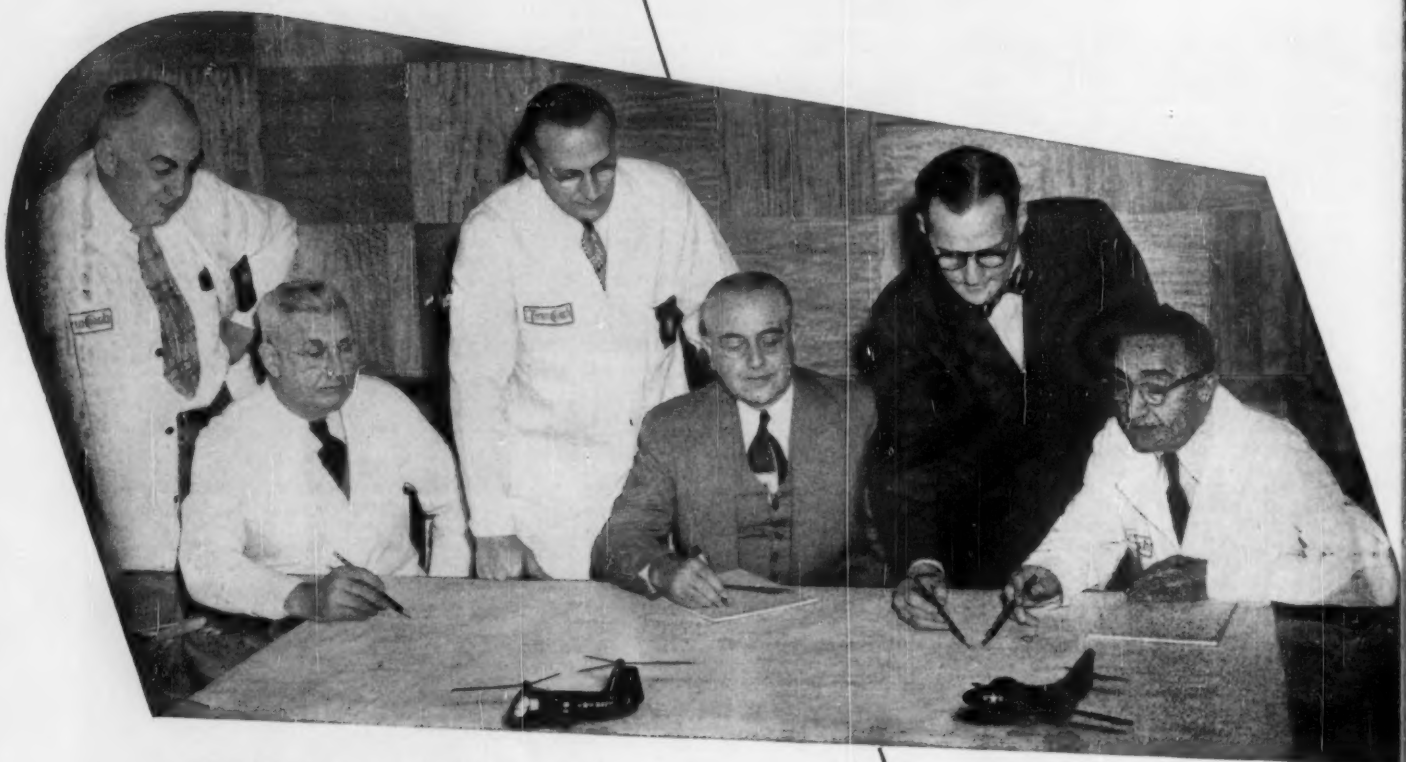
Bellows And Bellows Devices

CLIFFORD MANUFACTURING CO. WALTHAM, MASS.

Aircraft Heat Exchangers Valves Electronic Equipment



You can buy experience



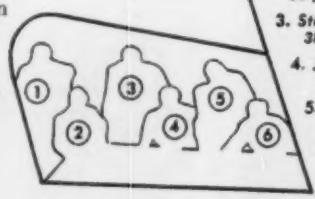
● Probably the outstanding characteristic of Twin Coach Aircraft Division plants is the wide *aircraft* experience of its personnel. This experience extends to all levels of the organization—from executive ... through supervision ... to production.

This means that prime contractors can entrust tooling design and construction to Twin ... can rely on Twin's producing assemblies to specification, in quantity, *on time.* Modern facilities, modern equipment and *experienced* manpower make Twin Coach a dependable source for every type of major airframe assembly.

A-7775

● 202 YEARS OF AIRCRAFT EXPERIENCE AT WORK...at Twin Coach

1. John Cudmore 27 years
2. Stanley Lesinski 38 years
3. Stephen Chojnacki 38 years
4. John Lee 36 years
5. John Mattison 25 years
6. Harry Schaefer 38 years



FAGEOL TWIN COACH AIRCRAFT

TWIN COACH COMPANY *Aircraft Division* **BUFFALO, N. Y.**

TWIN COACH PRODUCTS:

AIRCRAFT ASSEMBLIES • MOTOR COACHES • TROLLEY COACHES • SUPER FREIGHTER CARGO TRUCKS • FAGEOL GASOLINE AND PROPANE ENGINES • FAGEOL-LEYLAND DIESEL ENGINES

PRODUCTION BRIEFING

▶ **Guided Missiles Division,** Fairchild Engine & Airplane Corp., has expanded its reinforced plastics department by leasing a new plant in Copiague, N. Y. Facility will make missile parts, classified articles and special shipping containers. . . . Fairchild's Stratos Division has purchased military rights to a number of pneumatic controls and valves developed jointly by the company and Kendall Controls, Corp., Waltham, Mass., in addition to some Kendall basic patents and specific controls and valves.

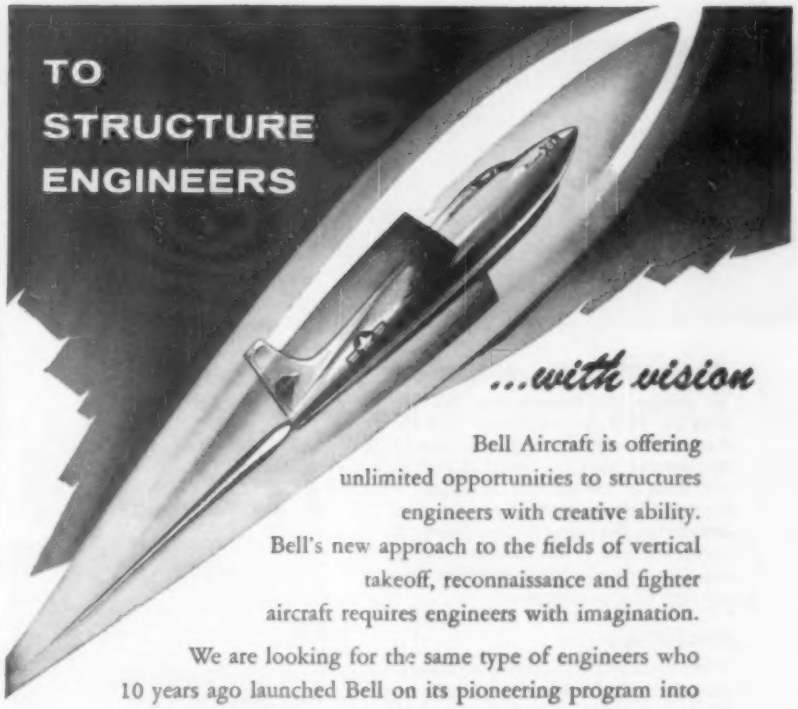
▶ **Aircraft Engine Division,** Ford Motor Co., Cicero, Ill., plans to build four more jet test cells costing slightly over $1.5 million for production trials on J57 engines. Firm now uses six cells, two for engineering tests.

▶ **Surplus military property disposal** information is being disseminated by Procurement Information Center, Old Post Office Building, Washington 25, D. C. Center handles data covering excess property of all three services.

AUTOMATIC EJECTION of plastic slugs cut by hole saws, saving the operator 2-3 min. in cleaning out the packed slug material after each cut, is simply handled by wrapping a 3½-in. length of steel wire twice around the ¼-in. saw pilot. The two loops are pulled tight to secure the wire on the pilot, then the rest of the wire is bent into a four-coil cone-shaped spring. The spring compresses as the saw makes its cut. When the cut is complete, spring pressure pops the slug out. The idea belongs to plastics fabricator Frank P. Rose, Jr., Temco Aircraft Corp., Dallas.

▶ **Accessory Products Corp.,** maker of pressure regulators, valves, filters and related equipment, has opened an addition to its Whittier, Calif., plant adding about 9,000 sq. ft. to existing area.

▶ **Dallas Airmotive, Inc.,** Tex., has received a large USAF engine overhaul contract entailing work on some P&WA R1830 engines, covering an eight-month period. With the new



Bell Aircraft is offering unlimited opportunities to structures engineers with creative ability. Bell's new approach to the fields of vertical takeoff, reconnaissance and fighter aircraft requires engineers with imagination.

We are looking for the same type of engineers who 10 years ago launched Bell on its pioneering program into supersonic and high altitude flight with such famous aircraft as the X-1, the X-2 and the 1650 m.p.h. X-1A

Today Bell offers structures engineers challenging assignments involving the so-called *"thermal barrier"* in supersonic and hypersonic flight. By helping to insure the success of tomorrow's revolutionary aircraft, you will have the opportunity to demonstrate your ability to the fullest. Excellent positions are now available for the following:

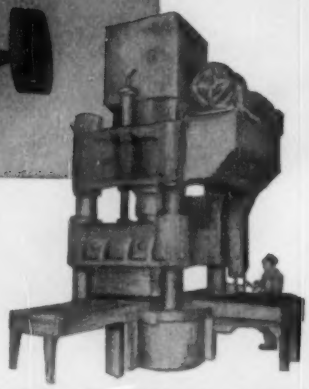
2 Project Structures Engineers 6 Structures Design Engineers
3 Structures Research Engineers 12 Stress Analysts
6 Structures Leadmen 5 Weight Engineers

At Bell, you receive top pay and liberal benefits including Life Insurance, Hospitalization, Surgery, Paid Holidays, Sick Leave, Vacations and Educational assistance.

Our Chief of Structures will review your qualifications. To arrange a personal interview send your resumé to: Manager, Engineering Personnel

BELL Aircraft CORPORATION

P. O. BOX ONE • BUFFALO 5, N. Y.



Research & Development

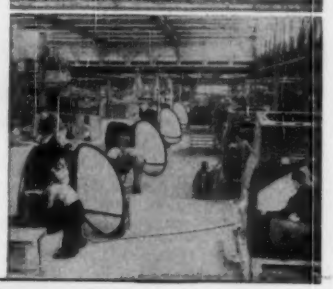
To design the outstanding HTK-1 and HOK-1 helicopters, Kaman Aircraft has assembled a complete engineering staff . . . men skilled in the fields of mechanical design, electronics and aerodynamics . . . men devoted to the research, development and production of electro-mechanical, aerodynamic, electronic and mechanical devices and systems.

Facilities

Their work requires large plant facilities, an impressive inventory of machine tools and technical equipment.

Production

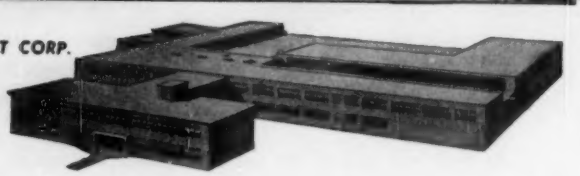
Kaman's production capabilities, which utilize materiel from the smallest electronic part to presses of huge capacity, all contribute to Kaman Performance and . . .



all are a part of

KAMAN

THE KAMAN AIRCRAFT CORP.
BLOOMFIELD, CONN.



FLETCHER

produces
fire
bombs
efficiently

PASADENA, CALIFORNIA DAYTON, OHIO WASHINGTON, D. C.

contract, the firm will be overhauling about 300 engines monthly. At the present rate, the firm will overhaul about 3,500 powerplants this year, compared with 1,901 last year. The firm has expanded its facilities to more than 100,000 sq. ft. and employs 200 overhaul technicians.

► **Grand Central Air Terminal**, Glendale, Calif., is to be subdivided into light manufacturing sites under a plan developed by Coordinated Construction, Inc., industrial developers and builders. Three phases will mark the work, with the air terminal and modification center to continue operation until the last step is begun.

► **Lockheed Aircraft Service-International, Inc.**, N. Y., has had existing contracts extended on an undisclosed number of military planes, a program going into 1955. Some of the work entails IRAN (inspect, repair as necessary), modification and routine maintenance of C-121, VT-29B, WV-2, RC-121, T-29A and T-29B aircraft.

► **Wyle Laboratories**, El Segundo, Calif., is expanding its air facilities for testing aircraft equipment. New equipment consists of a two-stage Worthington compressor driven by an 820-hp. electric synchronous motor having a continuous capacity airflow of 200 lb./min. at 250 psi.

Aircraft Industry Gets New Navy Contracts

Navy has awarded a $2,465,821 contract to Edo Corp., College Point, N. Y., for research and development programs.

Navy refused to disclose the work to be done by Edo.

Other Navy contracts include the following:

Philco Corp., Philadelphia, antennas and electronic components, $1,057,053.

Motorola, Inc., Chicago, research and development, $164,686.

Garrett Corp., Los Angeles, auxiliary powerplants, $226,890.

Sperry Corp., Great Neck, N. Y., research and development, $353,003.

Collins Radio Co., Cedar Rapids, Iowa, research and development, $117,360.

Sylvania Electric Products, Inc., Buffalo, N. Y., countermeasures, $257,274.

Massa Laboratories, Inc., Hingham, Mass., hydrophone, $164,780.

Cornell Aeronautical Laboratories, Buffalo, N. Y., continue analysis of air traffic control, $126,500.

Regents of the University of California, Berkeley, research, $100,000.

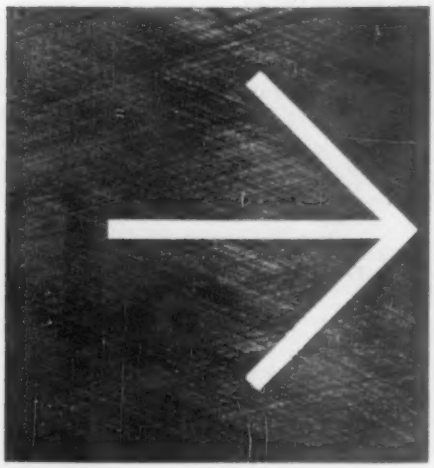
International T&T Corp., radio set subassemblies, $222,605.

Sikorsky Helicopter Division, United Aircraft Corp., Bridgeport, Conn., helicopter instrument installation, $155,462.

McDonnell Aircraft Corp., St. Louis, spare parts, $141,031.

North American Aviation, Columbus, Ohio, repair AJ-1 aircraft, $131,631.

Hallett Manufacturing Co., Inglewood, Calif., 120-volt diesel generators, with repair parts, $229,580.



precision production through microhoning

The controlled-abrading Microhoning process gives you

. . . fast, efficient, controlled stock removal—with a minimum of generated heat

. . . geometric tolerance in millionths of an inch

. . . diametric size in tenths of thousandths of an inch

. . . surface finish held to any desired roughness, duplicated on every part

. . . functional surface character with the amount of deformed or smeared metal less than that resulting from any other metal-shearing process.

Microhoning obtains high production on parts of any size or material—with manually-controlled or automatic equipment.

DESIGN AND MANUFACTURING SERVICE

For designing, testing and manufacturing precision parts, sub-assemblies and complete assemblies, our engineering, laboratory and production facilities offer a complete service. Experimental or production parts processed to your drawings and specifications; or we will design and manufacture to meet your most rigid functional specifications. For tolerance held to millionths of an inch on all types of equipment write to:

MICRO-PRECISION INCORPORATED
2205 Lee Street, Evanston, Illinois • DAvis 8-6771

MICROMATIC HONE CORPORATION
1535 Grande Vista Ave., Los Angeles 23, California • ANgelus 1-0309

MICROMATIC'S 25 YEARS SERVICE

Micromatic's 25 years of experience—working with processing and production engineers—in developing equipment and techniques for generating final accuracy on cylindrical and flat surfaces, can help you with your production problems.

JOB MICROHONING SERVICE

Should your organization lack the necessary facilities or find it inconvenient to set up for "short runs," Micromatic's Job Microhoning Department is at your service.

Skilled personnel provide prompt action on rush jobs and lend assistance in research work. For contract Microhoning of any cylindrical or flat surfaces of any size, your needs can be handled at:

MICROMATIC HONE CORPORATION
8100 Schoolcraft Ave., Detroit 38, Michigan • WEbster 3-7835

MICROMATIC HONE CORPORATION
1535 Grande Vista Ave., Los Angeles 23, California • ANgelus 1-0309

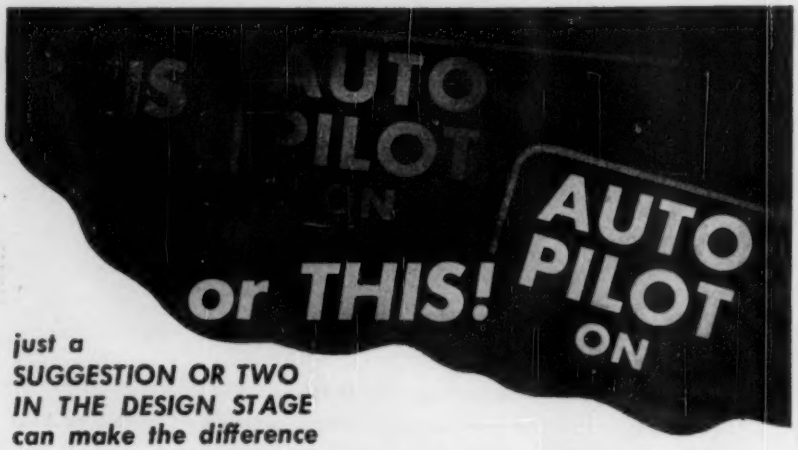
MICROMATIC HONE LIMITED
330 Grand River Avenue, Brantford, Ontario, Canada • 33166

For complete engineering, sales and service of Microhoning machines, tools, fixtures and abrasives, or further information concerning the Microhoning process, write or call our Detroit office.

MICROMATIC

MICROHONING

MICROMATIC HONE CORPORATION, 8100 SCHOOLCRAFT AVENUE, DETROIT 38, MICHIGAN



just a
SUGGESTION OR TWO
IN THE DESIGN STAGE
can make the difference

Production difficulties can usually be resolved in the design stage. Flexibility in the location of a light hole, the possibility of a slight relocation of a letter, word or legend, the introduction of a special light diffuser, or carrier, can make the difference between a uniform, well lighted unit or a unit which just falls within specification limits.

Our plants are completely equipped and staffed by experienced engineers trained to produce to the exacting requirements of specification MIL-P-7788, or any special requirement your particular application may demand.

your problems should be our problems in

EDGE-LIGHTED
PANELS and DIALS

If there is any question about it—just ask!

US RADIUM

UNITED STATES RADIUM CORPORATION

Executive and Sales Offices - 535 Pearl Street, New York 7, N. Y.

Plants and Laboratories at: Bloomsburg, Pa., Bernardsville, N. J.
AW-1 Whippany, N. J., North Hollywood, Cal.

AIRCRAFT STRUCTURES ENGINEER

Unusual technical opportunity in expanding Flight Research Organization engaged in development, installation and flight tests of aircraft instrumentation and flight control equipment. Minimum 5 years of aircraft structural design and stress analysis experience, including prime responsibility for the structural integrity of major air frame components required.

CENTRAL L. I. LOCATION
AT MAC ARTHUR AIRPORT
IN RONKONKOMA, L. I., N. Y.

PLEASE SUBMIT RESUME
TO BOX 218
RONKONKOMA, L. I., N. Y.
OR PHONE RONKONKOMA 9-8086
FOR INTERVIEW APPOINTMENT

...SPERRY...
GYROSCOPE CO.
FLIGHT RESEARCH DEPT.
MAC ARTHUR FIELD
RONKONKOMA, L. I., N. Y.

ELECTRICAL ENGINEER

B.S. with major in electrical power plus two years or more experience in laboratory testing. Must be able to organize and conduct laboratory investigations in A.C. and D.C. systems for aircraft, including inverters, alternators and related components. Will direct lab tests and prepare engineering test reports.

MATERIAL & PROCESS ENGINEER
METALLIC SANDWICH & SEALANTS

BSME or equivalent with a minimum of 2 years experience in one of the following:

Metallic Sandwich
(Stress Background)

Sealants (Fuel & Pressure Applications)

to assist in material and process specification preparation, design applications and development, and testing of materials.

Write or apply
Engineering Personnel Office
Dept. A.

NORTH AMERICAN AVIATION
Columbus 16, Ohio

USAF Contracts

Following is a list of recent USAF contracts announced by Air Materiel Command.

AC Spark Plug Div., GMC, Flint, Mich., computer assys., type A4, 27 ea., $43,390.

Aircraft Engr. & Maint. Co., Oakland, Calif., prototype mod. on RB-50F, 1 ea., $57,425.

Airpath Instruments Co., St. Louis, compass, magnetic, 6,575 ea., 185 ea., $121,342.

B. F. Goodrich Co., Dayton, wheel assys., 714 ea., $34,172; wheel assys., tip protection, 138 ea., 72 ea., 48 ea., $26,266.

Bendix Prod. Div., Bendix Aviation Corp., South Bend, Ind., wheel assys., 341 ea., 520 ea., 1,960 ea., $750,778.

Bill Jack Scientific Inst. Co., Solana Beach, Calif., K-50 aerial cameras, 10 ea., $156,212.

Bulova Research & Devel., Flushing, N. Y. camera body lenses, 25 ea., 16 ea., $307,904.

Federal Mfg. & Engr. Corp., Brooklyn, N. Y., projectors, 16-mm., sound, motion picture, 374 ea., $297,613.

General Electric Co., Cincinnati, special tools, $200,000; $218,000.

General Electric Co., W. Lynn, Mass., starter generators, 99 ea., $61,281.

Grimes Mfg. Co., Urbana, Ohio, light assys., $27,508.

H. Koch & Sons, Corte Madera, Calif., cases, carrying, 2,000 ea., $650,000.

Kearfott Co., Inc., Little Falls, N. J., components of type J-4 compass system, $101,773.

Lear Inc., Grand Rapids, Mich., spec. tools for autopilot component support, 26 ea., $26,536.

Leland Elec. Co., Dayton, inverters, 392 ea., $142,194.

Lockheed Aircraft Corp., Burbank, Calif., T-33A acft., spare parts, spec. tools, etc., $2,340,000.

North American Aviation, Inc., Los Angeles, mobile training units, F-86D, 2 sets, $564,122.

Red Bank Div., Bendix Aviation Corp., Eaton, N. J., inverter assys., 864 ea., $194,792.

Bendix Prod. Div., Bendix Aviation Corp., South Bend, Ind., brake assys., 3,157 ea., $1,021,350.

Wolverine Diesel Power Co., Detroit, gasoline engine generator set, 63 ea., $355,555.

The following contract awards were recently announced by Headquarters, Gentile Air Force Depot, Dayton, Ohio.

Allen B. DuMont Lab., 750 Bloomfield Ave., Clifton, N. J., tubes, type 70P7, cathode ray, 1,000 ea., $29,400.

Radiation, Inc., Melbourne, Fla., AN/UPM-19B, test sets, radar, maintenance spare parts, handbook data, 35 ea., $134,606.

Bomac Laboratories, Inc., Salem Rd., Beverly, Mass., tube, electron, JAN type 1B63A, transmitting, 2,000 ea.; tube, electron, JAN type 1B51, transmitting, 325 ea., $43,762.

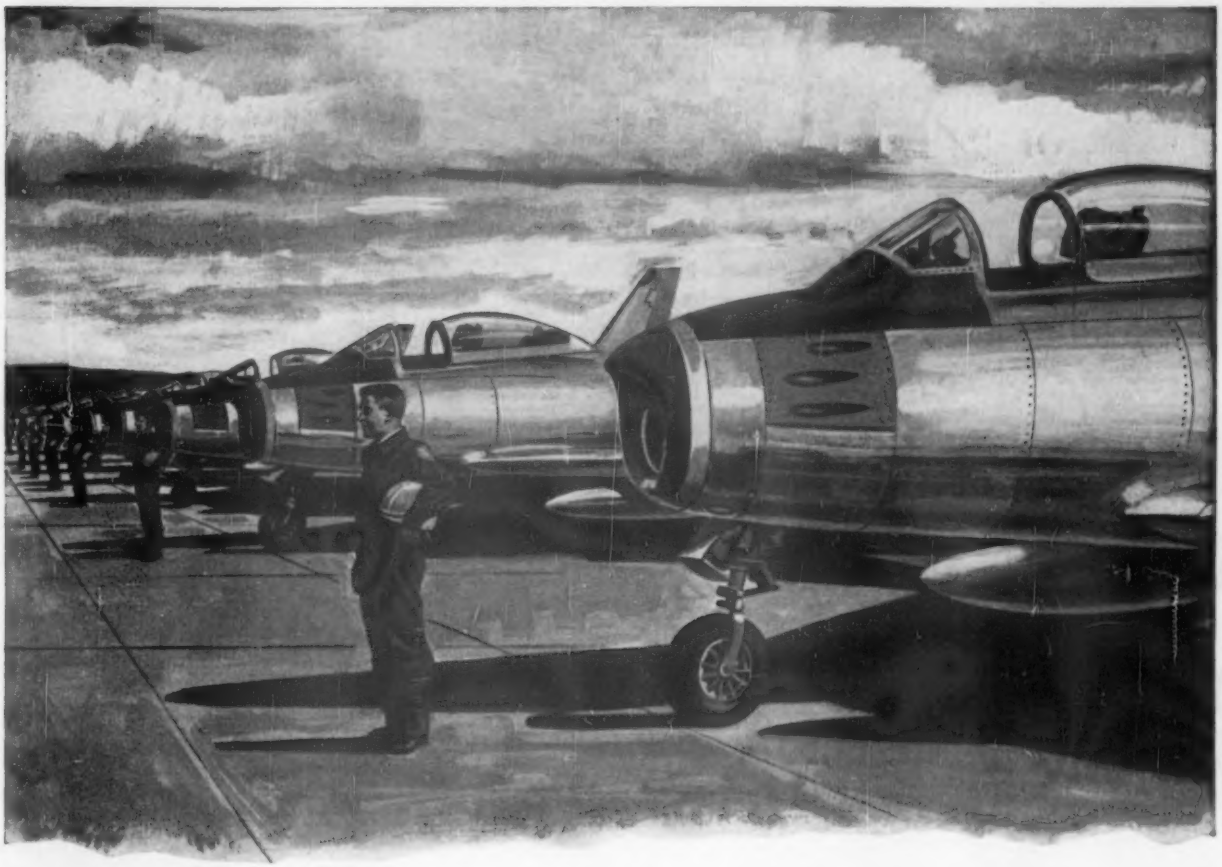
Eitel-McCullough, Inc., 798 San Mateo Ave., San Bruno, Calif., tube, electron, JAN type No. 4-65 A, transmitting, 6,000 ea.; tube, electron, JAN type No. 4x150A, transmitting, 13,700 ea., $445,515.

The following contract awards were recently announced by Rome Air Force Depot, Griffiss AFB, Rome, N. Y.

E. I. du Pont de Nemours and Co., Photo Products Dept., Wilmington 98, Del., paper, 12" x 200', recording type, ortho emulsion, SM, lightweight, 10,782 rl., $105,663.

General Aniline and Film Corp., Ansco div., Binghamton, N. Y., film, photographic, 25 mm. x 1,000', 240,000 ft.; film, photographic, 16 mm. x 1,200', 288,000 ft.; film photographic, 16 mm. x 100', 1,455 rl., $35,737; paper, 10" x 20", type #1E contrast 1, 3,466 pkg.; paper, 10" x 20", type 1E contrast #2, 3,150 pkg.; paper, 10" x 20", type

Here's a Story that's almost a Tradition...



"On Time" Deliveries COUNT AT CANADAIR

On time production of aircraft . . . on time deliveries to customers . . . getting things done . . . that's Canadair!

The record is there . . . airliners, jet fighters, jet trainers . . . Canadair has produced them all in quantity . . . and, on time!

Plant capacity . . . excellent equipment, superb teams of engineering and production specialists, modern and enterprising management . . . these are the factors that make Canadair.

That is why people who know say "You can count on Canadair" — your best recommendation in considering Canadair when buying military or commercial aircraft.

C-L CANADAIR LIMITED

CANADAIR

— AIRCRAFT MANUFACTURERS —

LIMITED, MONTREAL, CANADA

A subsidiary of GENERAL DYNAMICS CORPORATION, New York, N.Y. — Washington, D.C.

CAN-1157

C. H. Fish, design engineer assigned to the Icing Research Tunnel, measures impingement limits of ice on C-130 wing section. The tunnel has a temperature range of −40°F. to +150°F. and maximum speed of more than 270 mph.

Lockheed Increases Thermodynamics Staff

With six prototypes now in flight, Lockheed's Thermodynamics Department is expanding its staff to handle greatly increased research and development on future aircraft in commercial and military fields.

Lockheed's new icing tunnel, designed and installed to help handle the increased work load, is already in operation. It is the first icing research tunnel in private industry, and gives Lockheed's Thermodynamics Department unmatched testing facilities.

The tunnel enables Lockheed thermodynamics scientists to study in greater detail such problems as: thermal anti-icing; cyclic de-icing; various methods of ice removal; distribution of ice; rate of temperature changes in aircraft components; thermodynamic correlation between laboratory and flight testing; and development and calibration of special instrumentation.

Thermodynamics Career Opportunities—A number of new positions have been created by Lockheed's diversified expansion program. Thermodynamics assignments include such diverse projects as nuclear energy; supersonic fighters, trainers and transports; advanced versions of vertical-rising aircraft and bombers; turbo-prop transports; and a number of significant classified activities.

Lockheed offers you increased salary rates now in effect; generous travel and moving allowances; an opportunity to enjoy Southern California life; and an extremely wide range of employee benefits which add approximately 14% to each engineer's salary in the form of insurance, retirement pension, sick leave with pay, etc.

You are invited to write E. W. Des Lauriers, Dept AW-T-1, for a brochure describing life and work at Lockheed and an application blank.

LOCKHEED
AIRCRAFT CORPORATION
BURBANK **CALIFORNIA**

1E contrast #3, 1,250 pkg., $107,139.

Haloid Co., 2-20 Haloid St., Rochester 3, N. Y., paper, 20" x 24", contact, contrast #3, SW, SM, 350 pkg.; paper, 10" x 10", type 11A, contrast #1, 4,107 pkg.; paper, 8" x 10", type 11D contrast #2, 1,384 pkg., $27,066.

The following contract awards were recently announced by the Directorate of Procurement and Production, Ogden Air Materiel Area, Hill AFB, Utah.

Commonwealth Electric Co., 1901 Y St., P.O. Box 2067, Lincoln, Neb., installation of antenna, $33,250.

Gladden Products Corp., 635 W. Colorado Blvd., Glendale 4, Calif., misc. hyd. spare parts for T-28A aircraft, 1,127 ea., $35,687.

Weston Hydraulics, Ltd., 10918 Burbank Blvd., N. Hollywood, Calif. misc. spare parts for B-36 aircraft, 4,809 ea., $36,219.

The following contract awards were recently announced by Oklahoma City Air Materiel Area, Tinker AFB, Oklahoma.

General Electric Co., 1 River Rd., Schenectady 5, N. Y., valve and solenoid assys., 603 ea., $178,867.

General Motors Corp., Allison Div., Indianapolis, services and supplies necessary to overhal J35 engines., $1,030,000.

Vickers, Inc., 1400 Oakman Blvd., Detroit 32, pump assys., 116 ea., $84,100.

Weber Aircraft Corp., 2820 Ontario St., Burbank, Calif., cushion assys., armrests, etc., 5 ea., $54,667.

Douglas Aircraft Co., Inc., 2000 N. Memorial Drive, Tulsa, Okla., drag angle modification of B-47 aircraft, 41 ea., $230,648.

Stratos Div., Fairchild Engine and Airplane Corp., Bay Shore, L. I., N. Y., modification of cabin cooling units, 1,500 ea., $2,200,500.

Jacobs Aircraft Engine Co., 750 Queen St., Pottstown, Pa., studs, screws, nuts, etc., $46,861.

ARDC Contracts

The following contracts have been announced recently by Headquarters, Air Research and Development Command, Baltimore 3, Md.

AMERICAN INSTITUTE FOR RESEARCH, INC., 410 Amberson Ave., Pittsburgh 32, research and reports on the development of a comprehensive psychological test battery for use in longitudinal studies of age-related changes in intellectual, perceptual and psychomotor abilities (P.R. No. 290531), $38,754.

ARMOUR RESEARCH FOUNDATION of Illinois of Technology, Technology Center, Chicago 16, research and reports on the physiological effects of ozone (P.R. No. 298506), $45,254.

CORNELL UNIVERSITY, Ithaca, N. Y., development of electrochemical methods of separation and analysis for millimicrogram amounts of trace metals (P.R. No. 199175), $25,500.

HARBRIDGE HOUSE, INC., 1416 Massachusetts Ave., Cambridge, Mass., to develop an Air Force Research and Development Contracting Officer's handbook, $29,925.

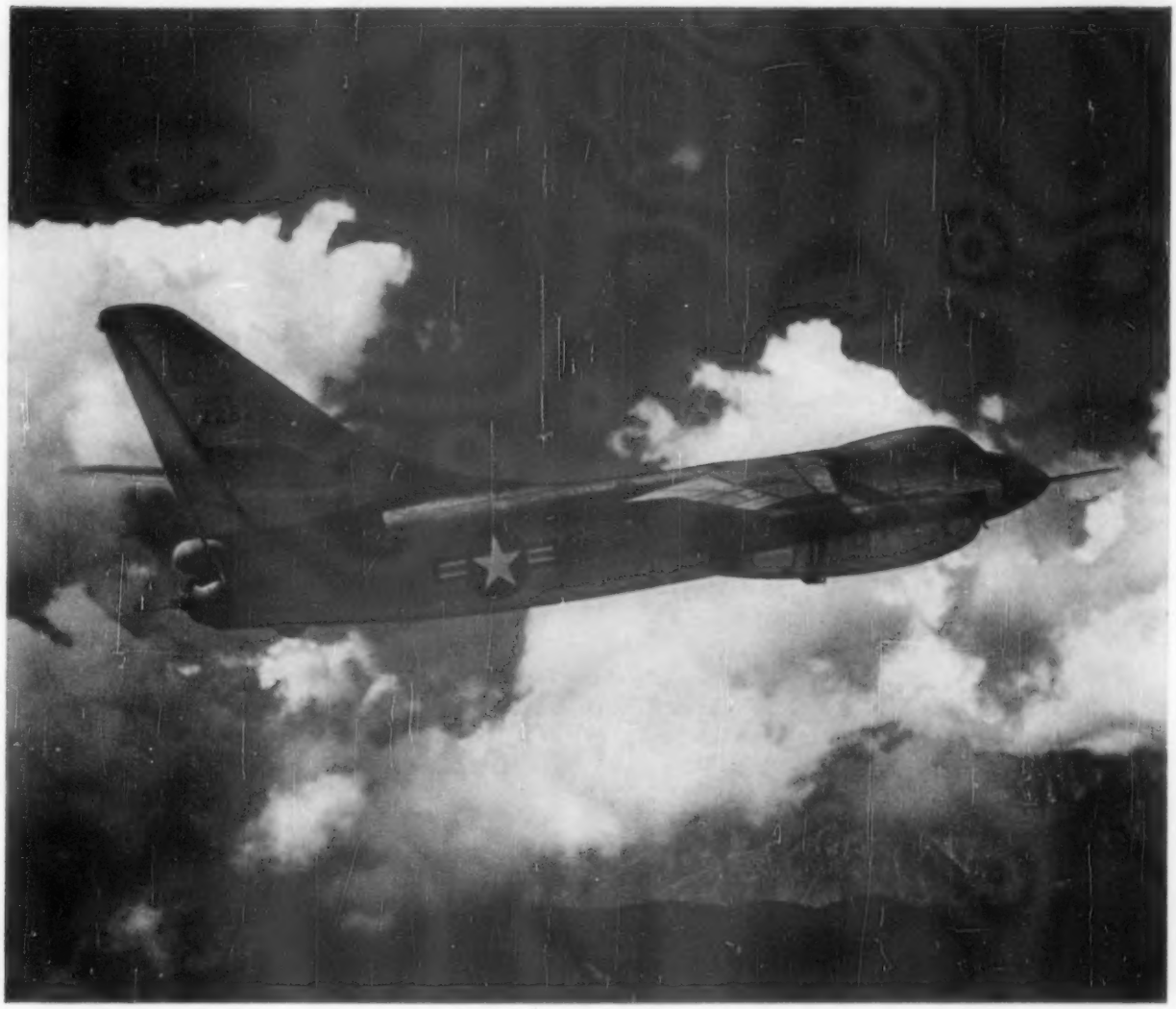
COURTLAND D. PERKINS, 80 Murray Pl., Princeton, N. J., preparation of monograph on flight testing (P.R. 225418), $28,500.

SVERDRUP & PARCEL, INC., Syndicate Trust Bldg., St. Louis, to cover overrun (P.R. No. 159599), $1,450,016.

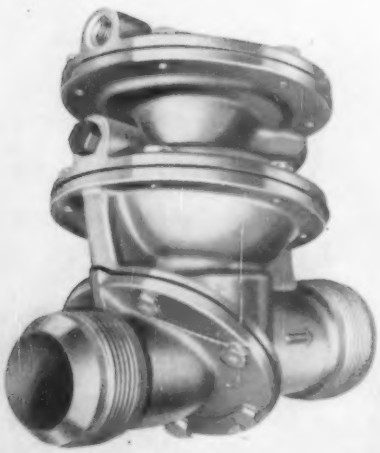
WESTINGHOUSE ELECTRIC CORP., 501 St. Paul Pl., Baltimore, study of air vehicle electrical systems and techniques, $100,000.

BROOKLYN COLLEGE, Bedford Ave. and Avenue H, Brooklyn 10, N. Y., research and reports on "Biochemistry of Tissue Trauma" (P.R. No. 302228), $31,907.

BRYN MAWR COLLEGE, Bryn Mawr, Pa., research and reports on "Influence of Environmental Factors Pertinent to Air Force Operations on Resistance to Infection" (P.R. No. 302244), $27,940.



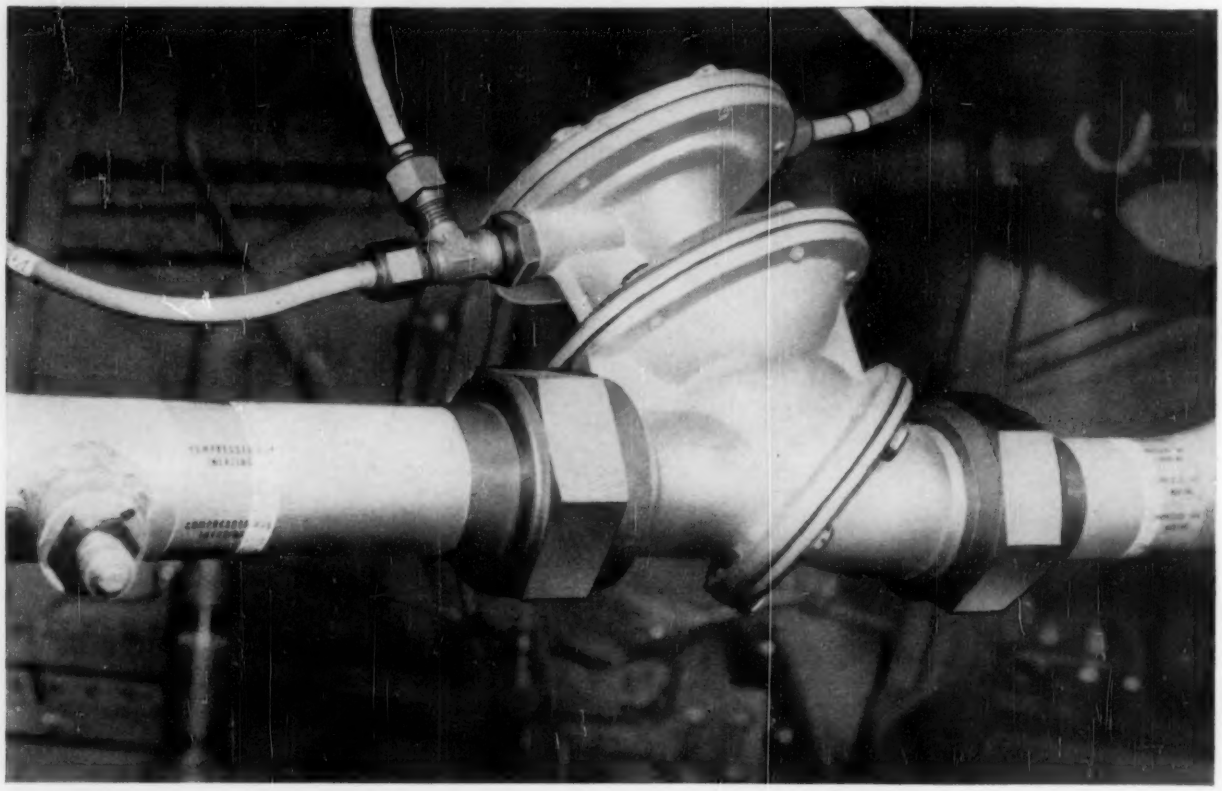
The Douglas RB-66 sweptwing bomber is a new twin-jet addition to the Air Force Tactical Air Command.



Explosive fuel tank fumes and excessive tank pressures eliminated in Douglas RB-66

Accessory Products Corp. *designs simple tank purging regulator to help solve complex fuel problem.*

See next page ▸

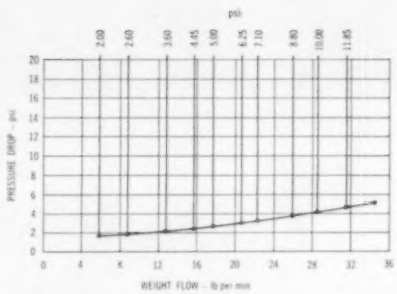


Stable, safe fuel tank pressure maintained by APCO's light-weight regulator

Often the most simple component designs are the result of greatest study and research by the supplier. Typical of Accessory Products Corporation regulator engineering ability is the simple fuel tank purging regulator produced for the Douglas Aircraft RB-66 jet bomber.

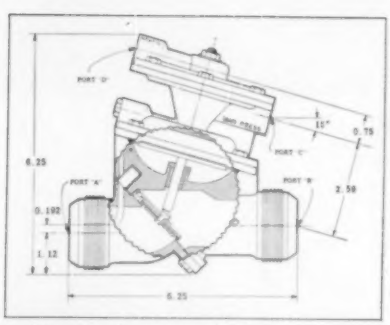
▸ Douglas aircraft required an automatic pressure regulator for fuel tank purging that would allow 28 pounds per minute flow yet maintain ½ psi tank pressure, plus or minus ⅛ psi. Inlet pressures between 5 and 25 psi were to be supplied with ambient temperatures between −65°F and + 165°F. The line flow temperature range was from −65°F to +200°F.

▸ Normally a modulating type regulator would be employed for such close tolerances, but APCO engineering developed a rugged compact off-on regulator with a slow actuating flapper valve that enables constant pressure control regardless of aircraft maneuvering. All qualification tests were met without exception as required by USAF MIL-E-5272 as well as Douglas Aircraft requirements. (See performance curve)



Performance curve of APCO tank purging regulator shows ability to handle unusually large volume with minimum pressure drop.

Meet APCO's Chief Engineer, Bill Smith.



Note the almost straight flow passage

Alert young men with young ideas head APCO depts.

Forever striving for simplification along with top product performance, Bill's engineering department has become widely recognized in the industry for its unusual solutions to the fluid flow and pressure problems created by high speeds and altitudes. Bill is typical of the young, progressive-minded specialists, born into aviation, to be found at Accessory Products Corporation.

Douglas praises APCO design ability

"Our experience with Accessory Products has been most gratifying," says Cliff Starr, Chief Power Plant Engineer, Douglas Aircraft, Long Beach. "Their exceptional design ability and extra application to the problem has made them very well qualified for our tank purging regulator job as well as the many other contracts they've fulfilled for us."

APCO invites your complex pressure regulator problems

Accessory Products Engineering is particularly interested in regulator problems calling for unusual design ability. Fluid control problems are our specialty. Write today or contact your APCO Sales Engineer to discuss your pressure regulator or valve problems.

FREE CATALOG DESCRIBING APCO SERVICE

APCO has designed and manufactured hundreds of different aircraft pressure regulators, valves and filters and allied components. Send for our free catalog covering many of our developments.

An APCO purging tank regulator is shown being calibrated by Warren Oien, chief test engineer.

Rigid quality control applied to each regulator

APCO's extra rigid tests of the operating characteristics of every unit is your guarantee of quality. Customer requirements are doubled and re-doubled at the test stations to detect any malfunctioning of the unit. Additional safety factors are designed into every APCO product over and above those required by the customer.

APCO ***Pressure Regulators***

accessory products corp.

engineering design • development • manufacturing

616 West Whittier Blvd., Whittier, Calif. • OXford 3-3747

New M-R-C SUPER-PRECISION *Instrument Ball Bearing* CATALOG

Write for Form 1543

MARLIN-ROCKWELL CORPORATION

Executive Offices: **Jamestown, N.Y.**

WHO'S WHERE

(Continued from p. 11)

V. H. McBride has been appointed manufacturing manager for Wallace Aviation Corp., Wallingford, Conn.

Charles R. Hussey has become passenger sales director for Northwest Orient Airlines. Also promoted are: **Jack A. Keillor,** to manager of agency and interline sales; **David D. Cleary,** to assistant manager, agency and interline sales.

Charles S. Basney has been promoted to new products manager for Barry Corp., Watertown, Mass.

A. W. Morgan is new assistant manager-operations for Convair's San Diego Division. Other changes: **George A. Covington,** assistant to the manager; **Roy H. Gilliland,** quality control manager.

J. M. Ferris has become domestic sales manager for Canadian Pacific Airlines.

Edwin J. Nilsson has been appointed eastern sales manager for the LearCal Division of Lear, Inc., Santa Monica, Calif. **Ralph S. Lehman** is new assistant to the commercial sales manager.

Robert Keene has been named advertising and sales promotion manager for Delavan Manufacturing Co., West Des Moines, Iowa.

Alfred M. Hudson, former executive of Colonial Airlines, is new assistant to the president of Princess Hotel and Cottage Colony of Bermuda.

S. W. Voorhes, manager of Century Engineers' office in Dayton, now has assumed control of the firm's office in Washington, D. C.

Arthur L. Hewitt has become director of interline and agency sales for Western Air Lines.

Edward J. Murphy is new passenger sales manager in the New York region for KLM Royal Dutch Airlines.

Mark L. Gerstle has been named public relations director for San Francisco International Airport, replacing the late **Edward Kneass.**

Hiram Brown, chief metallurgist for Solar Aircraft Co., San Diego, will present the 1955 International Exchange Paper at the International Foundry Congress next June in London.

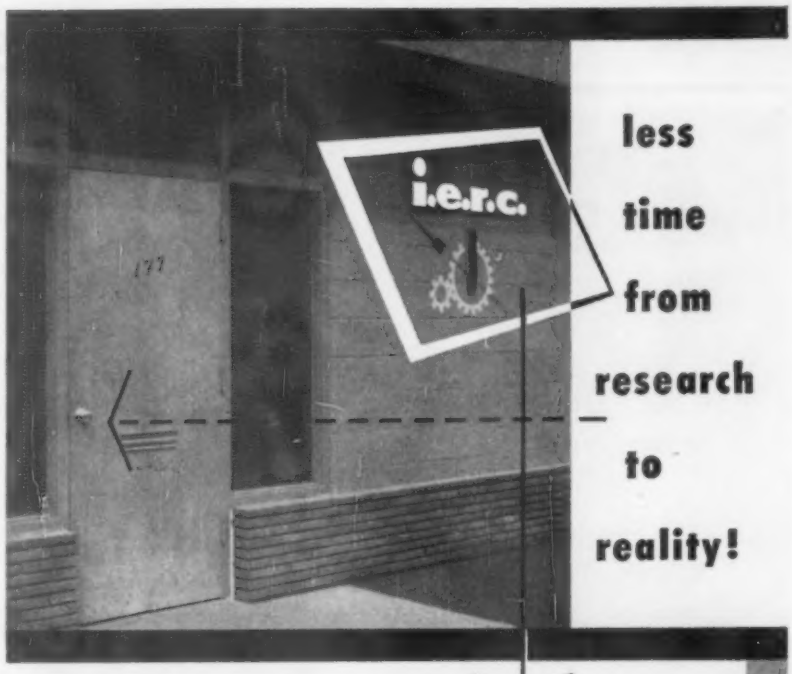
Lee B. Johnson, chief safety engineer for Northrop Aircraft, Inc., Hawthorne, Calif., has been elected president of the Veterans of Safety.

Edward L. Taylor, pioneer pilot and aviation writer, has been awarded a "Diploma of Honor" by the International League of Aviators.

Richards W. Cotton has become assistant to the president of National Co., Malden, Mass.

Dr. Theodore Theodorsen, former scientist for Air Research and Development Command, has joined Fairchild Engine & Airplane Corp.'s Engine Division, Farmingdale, N. Y., as a consultant.

Robert C. Blatt, onetime editor of Airports and Air Carriers, former technical editor of Aviation Maintenance and Operation and more recently associate editor of Electrical World, has been appointed director of publications for the American Society of Refrigerating Engineers, New York.



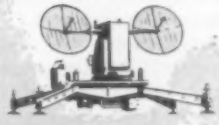
RIGHT PLACE...

I.E.R.C. has the best answers to your equipment failures due to tube heat and vibration!

I.E.R.C.'s research, design, development and manufacturing facilities are saving time and money — speeding "top level" projects into production for many leading electronic equipment firms.

For these achievements, I.E.R.C. is recognized as the finest source for effectively solving electron tube heat and vibration problems — the major cause of short tube life and other heat-vibration affected failures in electronic and electro-mechanical equipment.

Prevent future failures TODAY by calling I.E.R.C. or a convenient I.E.R.C. engineering representative nearest you!



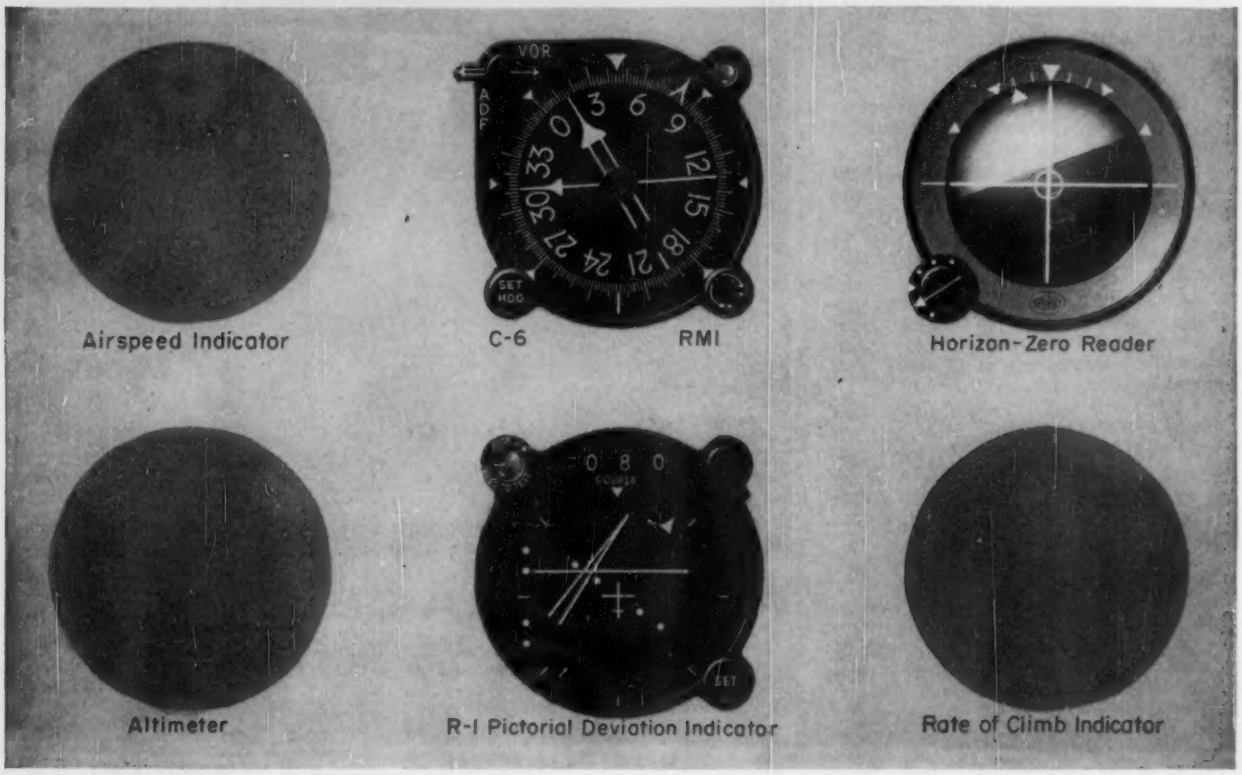
International ELECTRONIC RESEARCH CORPORATION

WRITE FOR LITERATURE
177 W. Magnolia Boulevard
Burbank, California

CONTACT THESE I.E.R.C. ENGINEERING REPRESENTATIVES:
HOLLIDAY-HATHAWAY, INC.
Cambridge, Mass.
WILLIAM JONES
Baltimore, Maryland
MAGNUSON ASSOCIATES
Chicago, Illinois
G. S. MARSHALL CO.
Pasadena, California
G. S. MARSHALL CO.
Redwood City, Calif.
THE MORT REED CO.
Rochester, New York
B. B. TAYLOR CO.
Rockville Centre, N.Y.
THOMSON ENG. SERVICE
Fort Worth, Texas

research · design · development · prototypes · manufacturing

AVIONICS



PILOT GETS MORE INFORMATION from Integrated Instrument System, which incorporates three new basic flight instruments.

New Sperry System Eases Pilot's Job

By Philip Klass

The new Sperry "Integrated Instrument System," which displays on three instruments the information requiring four or more on many of today's aircraft, shows considerable evidence of attention to human engineering principles. The three new instruments also incorporate associated controls now scattered around the cockpit panel and console.

The new IIS includes a redesigned Zero Reader computer, using no vacuum tubes, which reportedly provides much improved ILS approaches by virtue of new beam-coupling techniques. The system is designed also for easy integration with the Sperry A-12 autopilot, to eliminate duplicate gyros and accessories.

Pan American World Airways has ordered dual installations of the new Sperry system for its fleet of DC-7Cs (AVIATION WEEK Nov. 22, 1954, p.19).

▶**The Evidence**—Here are a few examples of how the new IIS is designed to ease the pilot's job in IFR weather:

• **Combined Zero Reader and horizon** indicator, employing newest type of spherical attitude presentation, enables pilot simultaneously to view cross-pointer instructions (fly up-down, fly left-right) as well as plane's pitch and bank angle, without shifting his eyes to a separate horizon indicator.

• **Pictorial presentation** of plane's position relative to ILS localizer or VOR beam uses a V-shaped pointer which instantly shows whether pilot is headed toward or away from station, eliminating need for a separate "to-from" indicator on the instrument.

• **Selector switches** located on new radio magnetic indicator enable pilot to select either VOR, ADF, or one of each type of station bearing for display on the RMI pointers with less chance of his becoming confused as to which pointers are indicating what.

Despite the multiplicity of information displayed, all instruments come in standard 3-in.-diameter size cases.

▶**Horizon Flight Director**—The new Sperry HZ-1 indicator is an answer to the pilot gripe that a flight director instrument tells him only what to do, shows nothing about the all-important airplane pitch and bank angles.

On the HZ-1, the plane's pitch and bank angles are shown by a spherical ball behind the Zero Reader cross pointers. The ball is suitably colored to indicate whether plane is in a pitch up or down attitude, and graduated scales show the extent of the pitch and bank angles.

The horizon ball is servo-driven about the pitch and bank axes from a remote (non-panel) non-tumbling vertical gyro.

▶**Pictorial Deviation Indicator**—The new Sperry R-1 pictorial deviation indicator bears little resemblance to the long-used ILS cross-pointer indicator which it replaces. The new R-1, like the course indicator made by Collins Radio, gives the pilot a pictorial presentation of his plane's heading relative to magnetic north and position relative to the VOR or ILS localizer beam. The new R-1 differs from the Collins instrument in the following respects:

• **V-shaped pointer** is used instead of a single VOR/ILS localizer pointer, eliminating the need for a separate indicator on the instrument to show whether plane is flying toward or away from the station.

• **Desired VOR radial** bearing set into the R-1 appears in digital form on a Veeder-type counter, instead of as a pointer against a compass rose as on the Collins unit.

• **ILS glide slope pointer** is included in the Sperry R-1. Collins puts this pointer on its approach horizon instrument instead of on its course indicator. When the R-1 is being used for cross-country omnirange flight, the horizontal glide slope pointer disappears off scale.

• **No magnetic heading** is displayed on the Sperry deviation indicator, unlike the Collins course indicator, because this information is presented on the Sperry RMI. However, the inner mechanisms of both the Sperry and Collins instruments are slaved to magnetic heading so that they rotate as the plane changes heading to display the correct angle continuously between airplane heading and the radio beams.

In the R-1, the inner mechanism rotates 180 deg. when the plane passes over the VOR station, giving a reversal of the V-shaped beam pointer. By flipping a small lever on the R-1, the pilot can instantly switch to a reciprocal of the VOR heading previously set in, without changing the "picture" being displayed.

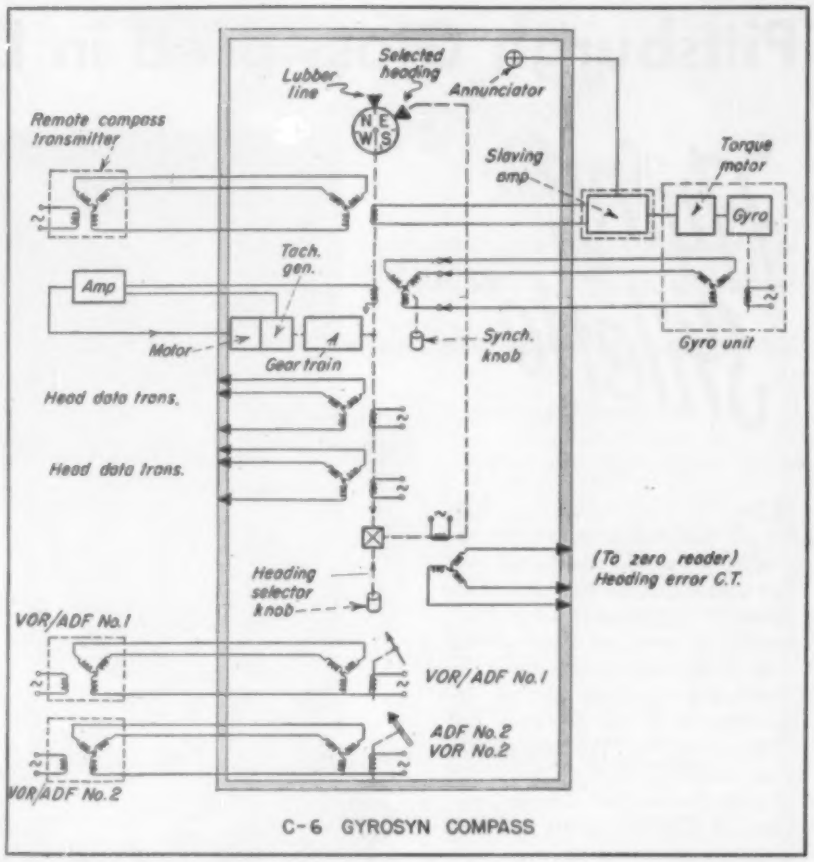
► **No Flight Director, But . . .**—The pictorial deviation indicator is not a computing flight-director type of instrument—this function is performed by the HZ-1 horizon flight director. However, Sperry points out that a pilot can approach a VOR or ILS beam asymptotically (without bracketing) if the tip of the V-shaped pointer is kept aligned with the lubberline atop the instrument.

By referring to only two instruments, the pictorial deviation indicator and horizon flight director, the pilot gets his fly up-down, fly left-right instructions, his plane's pitch and bank attitude, his position relative to the VOR/ILS localizer and glide slope beams.

► **Gyrosyn Radio Compass**—In appearance, the new Model C-6 Gyrosyn compass resembles a conventional RMI, except for the built-in controls to select either VOR or ADF for pointer display. However, the new instrument should provide more accurate magnetic heading indications because of the novel way in which it is slaved to the compass.

In a conventional RMI, the heading card is servo-driven from signals provided by a synchro on the directional gyro, which in turn is slaved to the remote compass. In the new C-6, the heading indicator is, in effect, directly slaved to the compass transmitter, eliminating one link, and one source of error, in the chain (see diagram, above).

However, the C-6 heading indicator is also tied into a remote DG so as to provide short-term stability to prevent momentary erratic compass signals (during a turn) from being reflected into the indication the pilot sees.



MORE ACCURATE HEADING indication results from slaving C-6 RMI dial directly to remote compass element while still using gyro's short-term stabilizing effect.

The C-6 also has a course marker which the pilot can set to the magnetic heading he wants to fly. This marker provides a visual reference on the C-6, and simultaneously sets in the same desired heading into the flight director.

► **Better ILS Approaches**—In redesigning the flight director computer, Sperry has not only substituted mag amplifiers and meter-modulators for vacuum tubes throughout, but has incorporated newer beam-coupling techniques as well. The result, Sperry says, is tighter coupling of the airplane to the ILS beams, providing better approaches regardless of the plane's configuration, CG location, or crosswinds.

In coupling to the ILS localizer, magnetic heading signals are not used. Instead, the computer employs beam displacement, plus rate-of-change of beam displacement signals. This allows the plane to weathervane and provides automatic crosswind compensation.

Because of irregularities in the localizer beam, some smoothing (integration) of the rate signal is necessary before it can be used. To compensate for lags set up by this smoothing process, Sperry also introduces signals proportional to bank angle, which are functionally equivalent to rate-of-change of azimuth displacement.

In the glide slope channel, the computer uses beam displacement and rate-of-change, without reference to pitch attitude, except to use a rate-of-change of pitch angle signal to compensate for lags due to beam rate smoothing.

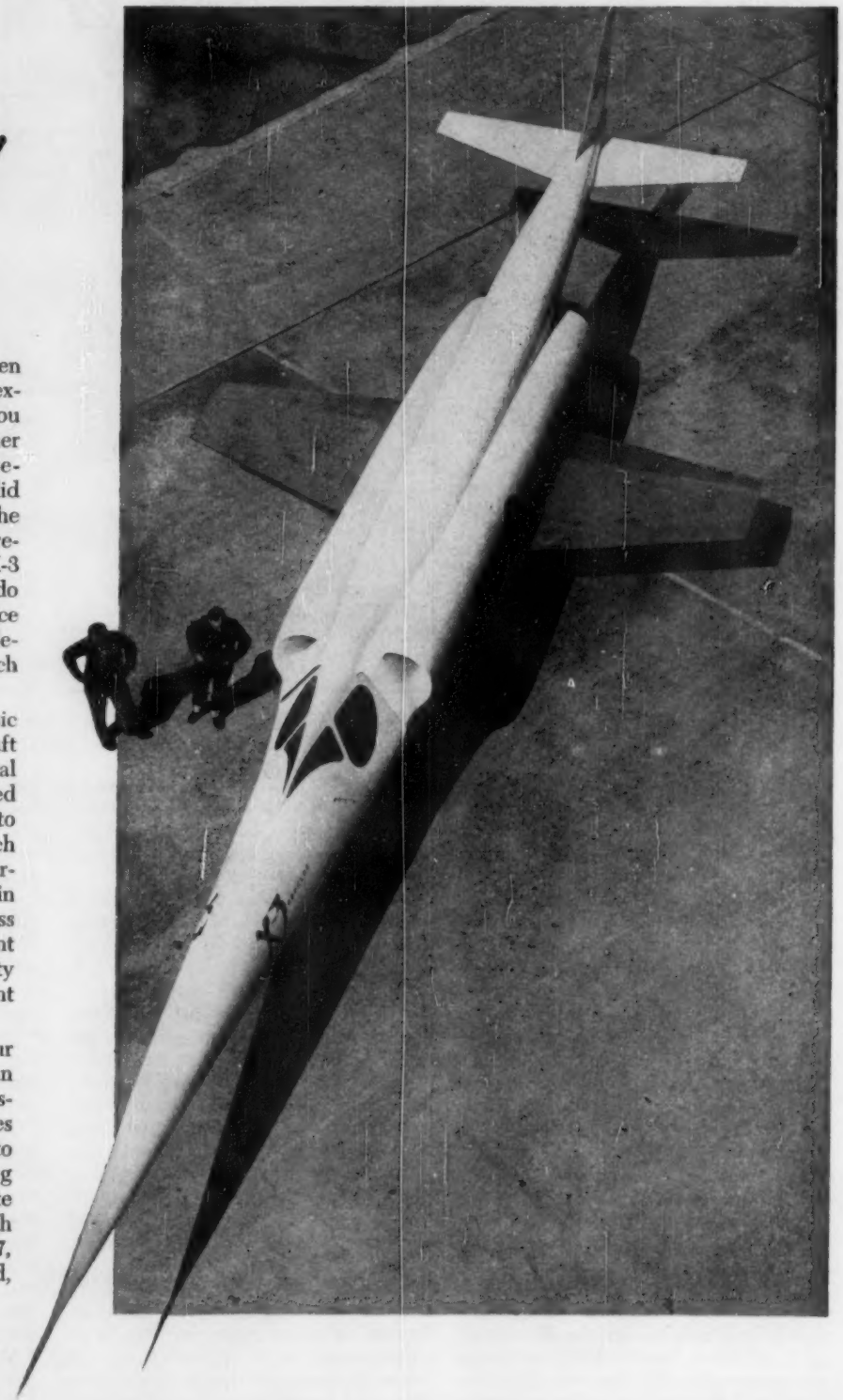
► **Integration Advantages**—By integrating the IIS with the A-12 autopilot, Sperry achieves several interesting advantages.

For example, one vertical gyro otherwise required for panel attitude indication is eliminated. At the same time, the system is rigged so that failure of the vertical or directional gyro used for panel indications does not incapacitate the IIS. The panel instruments may be switched to the gyros used in the A-12, providing a complete set of standby gyros.

► **Weight & Size Comparison**—A direct size and weight comparison of the new IIS and the older Zero Reader is difficult since the IIS performs many more functions and replaces some existing instruments. However, dual installations of IIS can be substituted for Zero Readers, on an A-12 equipped

Pittsburgh Glass used in Douglas X-3

"Flying Stiletto"



■ SECRET! There are times when we all dislike that word. For example, we would like to tell you the details (as we have for other aircraft in previous advertisements) of how the work we did with Douglas helped to meet the terrifically exacting glazing requirements of the Douglas X-3 "Flying Stiletto." We may not do this, because the performance characteristics and detailed designs of this important research airplane are classified.

One of our most important basic policies is to help each aircraft company with its experimental projects, regardless of the limited requirements for glass, and to make an "all-out" effort in each case to solve the glass engineering problems. We believe that in doing this, Pittsburgh Plate Glass Company is making an important contribution to national security and the technical advancement of the industry.

Why not take advantage of our experience next time you have an aircraft glazing problem? Pittsburgh technical representatives will be glad to work with you, to help you work out proper glazing for your aircraft. For complete information write to Pittsburgh Plate Glass Company, Room 5167, 632 Fort Duquesne Boulevard, Pittsburgh 22, Pennsylvania.

PAINTS · GLASS · CHEMICALS · BRUSHES · PLASTICS · FIBER GLASS

PITTSBURGH PLATE GLASS COMPANY

IN CANADA: CANADIAN PITTSBURGH INDUSTRIES LIMITED

plane, with a net saving of 14 lb., a Sperry analysis indicates.

The flight director computer itself comes in a ½ ATR-size case, weighs approximately 8 lb. In addition, a servo-amplifier package, also in a ½ ATR and weighing 8 lb., is required for each set of IIS panel instruments. Two such servo-amplifier packages are required for dual installations. Each package contains four servo amplifiers, one to drive the C-6 heading dial, another to slave the inner mechanism of the R-1 to magnetic heading, and two others to slave the horizon ball in pitch and bank to the remote vertical gyro.

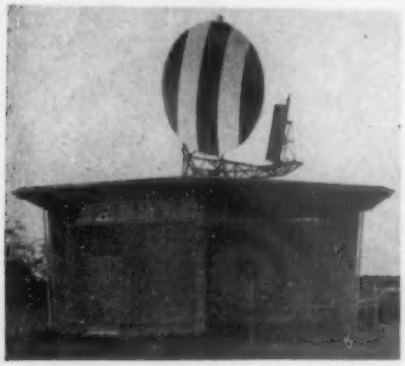
The package also contains a "to-from" sensor which reverses the polarity of signals to the R-1 inner mechanism when the plane passes over a VOR station.

The servo amplifiers themselves use a vacuum-tube input stage and magnetic amplifier output. For maximum reliability, the input stage uses a dual section tube with the two sections paralleled so that most types of failures in one section will not impair overall operation.

Manufacturers Report Telemetering Aids

A new 4-watt FM transmitter, weighing only 2 lb., and designed to operate from a subcarrier oscillator in an FM/FM telemetering system in the 215 to 235-mc. band, is one of several recently announced devices suitable for telemetry.

The new type 840 transmitter, developed by Raymond Rosen Engineering Products, Inc., is capable of ±125 kc. nominal carrier deviation, ±150 kc. peak. Modulation frequency range covers all RDB subcarrier channels from

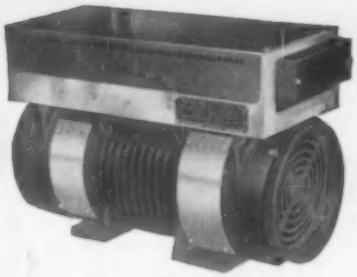


Swiss Set

Simple structure at Zurich (Switzerland) airport houses recently installed 450-kw. surveillance radar built by Cossor Radar Ltd. of London. New S-band set includes moving target indication (MTI) provisions, particularly useful in eliminating radar echoes caused by nearby Alps.

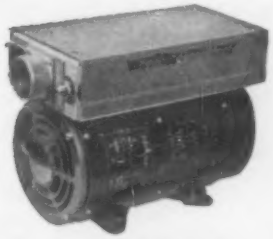
Bendix Red Bank

HIGH ALTITUDE INVERTERS



Type 32E03-3

Bendix Red Bank 32E03-3 and MG-54 Inverters give the continuous full AC power output needed to operate flight control instruments, radio communications and radar at today's higher altitudes and ambient temperatures. These two high altitude champions make the customary de-rating at higher altitudes unnecessary. They can deliver this outstanding performance because they have been specifically designed for high altitude operation and are not simply modernized versions of older designs. Further, their integral voltage and frequency controls enable them to hold the close tolerances required in modern aircraft.



Type MG-54

Specifications
Type 32E03-3
(Conforms to USAF drawing 53B6227 and AN-I-10b)

Input DC	
Voltage Range	26 to 29
Current Range	160 to 180
Current at 27.5 volts	165
Output AC	**Single Phase**
Volts	115±4%
Amperes	21.7
Volt-Amperes	2500
Frequency-cps	400±10
Power Factor	.9 lag to .95 lead
Efficiency	55%
200% load	5 sec.
150% load	5 min.

WEIGHT: Approximately 62 pounds.

MAXIMUM OVER-ALL DIMENSIONS: 7¼" wide x 11¼" high x 17" long.

ALTITUDE	AMBIENT TEMP. RANGE
Sea Level	−55°C to +85°C
35,000 ft.	−55°C to +40°C
50,000 ft.	−55°C to +20°C

Type MG-54
(Conforms to Navy drawing E-51A1A9 and MIL-I-7032)

Input DC	
Voltage Range	26 to 29
Current Range	24.1 to 21.6
Current at 27.5 volts	22.8
Output AC	**Three Phase**
Volts	115/200±4% (115±4%, single phase)
Amperes	1.25/.723 (2.17, single phase)
Volt-Amperes	250 (single phase, three phase, or single and three phase combined)
Frequency-cycles/sec.	400±10
Power Factor	0.8 lag to .95 lead
Watts at 0.8 PF lag	200
Efficiency	40%
200% load	5 sec.
150% load	5 min.

WEIGHT: Approximately 17 pounds.

MAXIMUM OVER-ALL DIMENSIONS: 5⅛" wide x 8" high x 12" long.

ALTITUDE	AMBIENT TEMP. RANGE
Sea Level	−55°C to +85°C
50,000 ft.	−55°C to −10°C
65,000 ft.	−55°C to −10°C

Manufacturers of Special-Purpose Electron Tubes, Inverters, Dynamotors and Fractional HP D.C. Motors.

Bendix Red Bank

EATONTOWN, N. J.

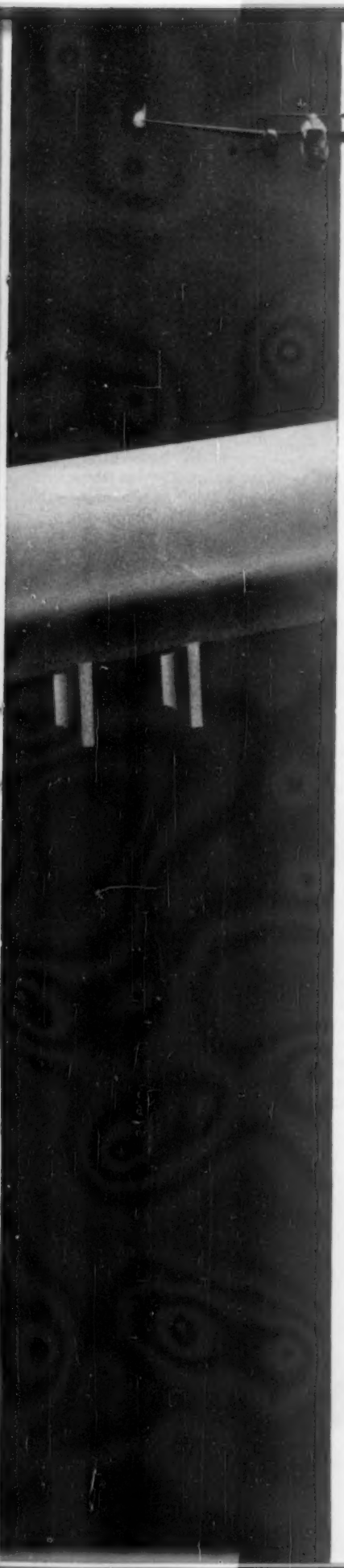
DIVISION OF

Bendix AVIATION CORPORATION

West Coast Sales and Service: 117 E. Providencia, Burbank, Calif.
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.
Canadian Distributor: Aviation Electric Ltd., P.O. Box 6102, Montreal, P. Q.

TOMORROW'S AIRCRAFT: *One step closer*

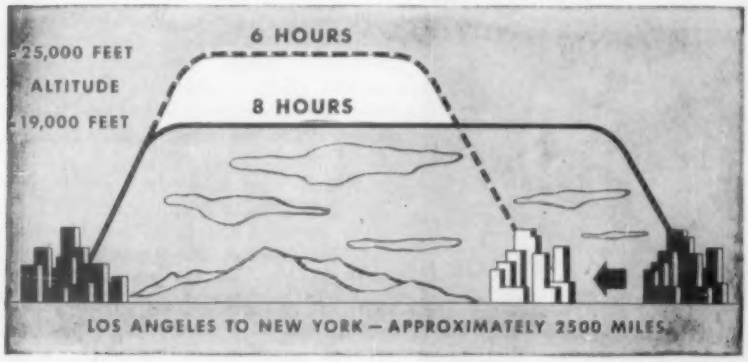
Jet pods give aircraft new speed and range ...greater utility



Westinghouse J34's—podded and slung under the wings—give the U. S. Navy "Neptune" extra speed and reduce the take-off run. On missions, they can give the extra margin of power to get on target faster and away quicker. Drag is less and performance even better than anticipated.

The record of the J34 shows it well fitted for such auxiliary use. It has been proved in tough operational service; has advanced to a 720-hour overhaul life; performed up to 56,000 feet; withstood severe battle damage; and is quick to install and easy to maintain. The J34 history shows progressive design changes and performance improvements to its present highly developed state giving the best specific fuel and weight characteristics available in its class.

Westinghouse aviation engineers are ready to give you a wealth of information on the use of J34's to achieve extra speed, range, and endurance for both military and commercial operational requirements—a ready-made opportunity to bring tomorrow's aircraft . . . One Step Closer. Westinghouse Electric Corporation, Aviation Gas Turbine Division, P. O. Box 288, Kansas City, Missouri. J-91017

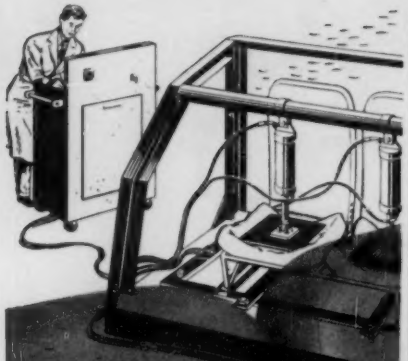


Tomorrow's Aircraft Brings Cities One Step Closer. The dotted line shows how J34 pods can help aircraft reach optimum altitude faster, maintain more efficient cruise control, and retain extra margins of economy in time and distance. En route time can be drastically reduced; as, for example, the Los Angeles to New York run which might be cut as much as 25%. J34 auxiliaries can give these advantages to aircraft currently in use or planned for future requirements.

Jet Propulsion • Aircraft Electrical Systems and Motors • Airborne Electronics • Wind Tunnels to Plastics

YOU CAN BE **SURE**...IF IT'S

Westinghouse



there's
Remarkable
Strength
in TECO
Airline seats!

Thorough load testing on our equipment provides answers that make TECO seats "traffic tough" and extra safe. TECO's test rig, used for certification, is the only one of its kind privately owned. With it new TECO designs of remarkable lightness and strength are produced.

TECO — the *best* seat for *any* airline!

TECO INC.

2501 No. Ontario St. • Burbank, California

Airline • Executive • Military Aircraft Seats

400 cps. to 70 kc., and frequency response is flat within 3 db. from d.c. to 100 kc. Total harmonic distortion at 125 kc. deviation is 2%, according to manufacturer. Frequency drift is within 0.075% over temperature range of -5C to 70C, less than 0.1% from sea level to 60,000 ft.

The same manufacturer has announced a new RF power amplifier, Type 865C, rated 25-25 watts from a 1 to 3-w. drive, has a 300-kc. minimum bandwidth over frequency range of 215 to 235 mc.

After temperature stabilization, output variation will not exceed 1½ db. over temperature range of -65C to 100C, or at altitudes ranging up to 70,000 ft.

Address: Raymond Rosen Engineering Products, Inc., 32nd and Walnut Streets, Philadelphia 4, Pa.

Other new telemetering devices include:

• **Sub-min preamplifier**, Model F-410, weighing only 6 oz., has selective gains of 10, 30 and 100, and frequency response of 5 to 20,000 cps. The four-tube device includes a cathode follower to give a 100 megohm input impedance. Unit measures approximately 2¾ x 1¼ x 2¼ in.

Manufacturer: Gulton Mfg. Corp., Metuchen, N. J.

• **RF power amplifiers**, available in two models. Type REL-09, rated 10 watts, tunes from 215 to 235 mc., weighs only 12 oz. The REL-06, covering same frequency range, provides 18 watts, weighs 2¼ lb. Amplifiers are available from Rheem Research & Development Labs, 9236 E. Hall Road, Downey, Calif.

Rheem also is producing subminiature instrumentation amplifier, REL-12, with response flat to within 1% from 5 to 100,000 cps. Units can be supplied with fixed or variable gains of 10, 100, and 500. Linearity is within 1%, input impedance is 1 to 20 megohms, and output impedance is under 175 ohms. Rheem says that the unit has been designed to operate in missile or aircraft environments.

FILTER CENTER

► **New Helicopter Radar**—Bendiv Aviation's Pacific Division reportedly is developing a lightweight airborne radar specifically for helicopter use, further strengthening its position in the copter navaid field. Bendix-Pacific recently obtained U. S. manufacturing and sales rights to the British Decca navaid system (AVIATION WEEK Nov. 15, 1954, p. 17), prominently mentioned, along with airborne radar, as likely future copter navaids.

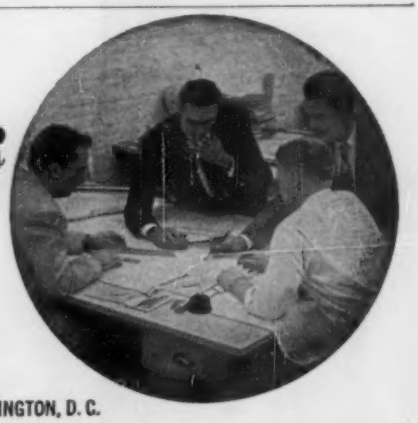
► **AIEE Takes Dim View of Aviation?**—American Institute of Electrical Engineers would appear to have little faith in the future of aviation or the role of electricity in aviation, judging from the technical sessions scheduled for its annual winter convention in New York, Jan. 31-Feb. 4. Of 90 technical sessions scheduled, not a single one is devoted to aviation as such, although surface transportation merits two sessions and even telegraph systems rates one. In contrast, Institute of Radio Engineers last year scheduled three full technical sessions for aviation.

► **Data Reduction Services**—Land-Air, Inc., has contracted with the Army to provide data collection services at White Sands Proving Grounds. Cook Research Labs division of Cook Electric Co. will provide similar services and operate USAF's whirl tower at El Centro, Calif.

► **Lear Wins Hot Competition**—Navy BuAer reportedly has selected Lear to produce low-drift, high-latitude MA-1 directional gyro systems after a hotly contested competition that involved a dozen gyro manufacturers. The Lear gyro, using fabricated rather than cast structural members, reportedly has a free-gyro drift rate of 1 to 2 deg. Slaving amplifier will use transistors and magnetic amplifiers. —PK

FLETCHER

designs
products
economically



PASADENA, CALIFORNIA DAYTON, OHIO WASHINGTON, D. C.

TO THE VICTOR...

MACKAY TROPHY
1951–1954

HARMON TROPHY
1951

GUNNERY TROPHY
1954

ALLISON TROPHY
1951–1953

BENDIX TROPHY
1949

1954
U.S.A.F.
OUTSTANDING UNIT CITATION

Republic's ***THUNDERJET!*** *In peace as in war, the skill and training of American airmen have won for the F-84 the "title" of* ***The World's Most Honored Airplane.*** *Famed as the mighty U.S. Air Force workhorse of the Korean War . . . actively serving NATO and our other allies . . . Our sincere congratulations to the USAF officers and airmen who flew or serviced the missions which gained for them these and many other awards.*

CEILING UNLIMITED *for the young ambitious man . . . new vistas of education, travel and security . . . all these are available to career airmen in the U.S.A.F. Every day you're in brings you greater satisfaction in the knowledge that yours is a vital and rewarding service to your country . . . to yourself.*

REPUBLIC AVIATION

FARMINGDALE, LONG ISLAND, N. Y.

Designers and Builders of the Incomparable **THUNDER-CRAFT**

65

OVERSEAS SPOTLIGHT

mercial pilot trainer. The Safir is being

BOUTS MAY LOOK

ROLLS-ROYCE

makers of aero engines

for forty years,

make the

DART

PROPELLER TURBINE ENGINES

which power the

Vickers Viscount airliners

ordered by Capital Airlines

for domestic services

in the U.S.A.

ROLLS-ROYCE AERO ENGINES FOR SPEED AND RELIABILITY

ROLLS-ROYCE LIMITED · DERBY · ENGLAND

66

NEW AVIATION PRODUCTS

sisting of a coil inserted in the air-gap of a permanent magnet. When

OVERSEAS SPOTLIGHT

Hawaii Base Plan Revised

Victor Pastushin's new Hawaiian plane servicing firm—Hawaiian Airmotive—has withdrawn its request for an exclusive franchise as a fixed-base operator at Honolulu International Airport (AVIATION WEEK Nov. 8, p. 76).

The action came after almost all the airlines using the airport expressed opposition to granting an exclusive franchise, although they expressed a willingness to see Hawaiian Airmotive set up operations on an open competitive basis.

Ronald L. Burla, vice president in charge of the company, said that "operations will start as soon as the new lease is signed." He said, however, that there would be a "considerable curtailment" of the company's plans.

"Without the protection of an exclusive lease we will not be able to hire as many people as we had hoped, and we certainly will not be able to put up the large capital investment and equipment we had planned," he said. Pastushin had planned an investment of about $250,000 and expected to employ 200.

Saab Produces New Safir

STOCKHOLM

Saab Aircraft Co. has started production of the Safir 91C, a four-seat version of the company's single-engine all-metal lightplane at its main plant in Linkoping. The 91C can be used for executive or pleasure travel, or as an air taxi or ambulance. As an ambulance, it has room for a stretcher and medical attendant.

Saab-Linkoping is also producing the Safir 91B, three-seat military and commercial pilot trainer. The Safir is being used by pilot training organizations in eight countries, says Saab.

Powers Clash in Austria

VIENNA

The Soviet members of the Allied Council for Austria have vetoed a plan for an Austrian air-rescue service to aid victims of winter avalanches. The Reds charge the government's request for five lightplanes and five copters is a device to permit resumption of Austrian military activity, outlawed by the Allies in 1945.

The U. S. view was that there was no more relationship between flying tiny rescue craft and military jet fighters than between driving an automobile and a tank.

Big Red Airfleet up North

OSLO

About 4,000 modern aircraft are stationed at over 400 airbases in the Soviet area adjoining Scandinavia, according to expert opinion, the newspaper Morgenbladet reports.

Capacity of these bases is given as 15,000 planes.

Fog Fighter in Production

ROME

Societa Italiana Dalmar of Milan has started mass production of its fog-dispersing apparatus for airports. Similar to the Fido technique, the Dalmar system uses methane gas instead of liquid fuels for heating the air and burning off the fog.

The company claims that a landing made with the Dalmar system costs one-third one made with Fido. It is expected that later developments will bring the cost still lower.

New Stores Ejector Overcomes Mach 1 Speeds

North American F-100 Super Sabre is one of several highspeed Air Force jet fighters equipped with new Bohanan Mfg. Co. dual-piston force ejector racks for safely disposing of external stores at transonic or supersonic speeds. Dual cartridge-activated telescoping pistons on each rack exert 20,000-30,000-lb. average force through an 8-in. stroke directly into the mounting lugs of the tank or bomb. The racks consist of two-hook carriage and suspension for either 14-in. or 30-in. center-to-center lug spacing with hook loads designed to take 120,000 lb. ultimate. The 14-in. ejector weighs about 30 lb.; the 30-in. model about 45 lb., says the Los Angeles manufacturer.

BOLTS MAY LOOK ALIKE...But there is a Difference!
Be Sure of the Best Always Specify ABC
Illustrated are just a few of our standard and special bolts and fasteners for the aircraft industry.
Write Today for Complete Descriptive Catalog
AIRCRAFT BOLT CORP.
701 WEST GARVEY BLVD.
EL MONTE, CALIFORNIA

FLY HIGHER FASTER
— land refreshed!
—USE
Scott
OXYGEN
EQUIPMENT
● One of the major reasons for the tired feeling after a flight, even at altitudes under 10,000 feet, is oxygen starvation, or flight fatigue. You can take advantage of more economical higher altitudes, modern navigation techniques and reduce flight fatigue by installing a Scott fixed oxygen system in your ship.
SIMPLEST one positive control . . . accommodates up to 50 people.
LIGHTEST "per hour" of oxygen carried, plus smoke and fume protection for crew.
LOWEST COST — For example, the #8500 system for Twin-Beech installation costs approximately $390.
Write today for installation diagrams on your aircraft!
Scott
SCOTT
AVIATION
CORP.
225 ERIE STREET
LANCASTER, N. Y.
Export: Southern Oxygen Co.
15 West 57th Street New York 19, New York

NEW AVIATION PRODUCTS

Portable Kit Speeds Jet Hose Assembly

Complete jet aircraft hose assemblies can be produced on the spot in a few minutes using a portable kit packed in two carrying cases, the manufacturer notes.

The kit has been developed specifically for field servicing of Resistoflex-T R500 hose used by the U. S. Navy and several jet engine and airframe makers.

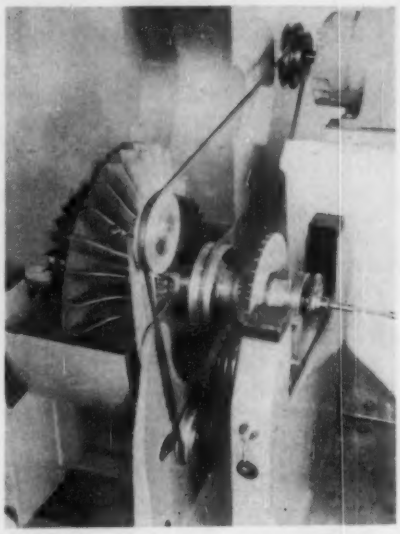
The kit consists of a crimping tool, hydraulic pump, adapter bushings, mandrels, crimping fingers and other items and simplifies engineering of new installations and stocking and maintenance problems, the maker points out.

Resistoflex Corp., Belleville, N. J.

Precision Unit Detects Jet Rotor Unbalance

(McGraw-Hill World News)

Stockholm—A balancing machine that can detect vibrations of 0.00001-in. amplitude in turbojet compressor and turbine rotors is being produced by a Swedish concern. In addition to detecting unbalance in these components, the device also locates the angular position of the condition, either by referring to a scale or by optical means.



SWEDISH machine for rotor inspection.

The manufacturer notes that the machine, designated YRB 30, is also useful for checking rotors of pumps and electric motors and fans.

Measurement is accomplished by suspending the rotor, up to 40 in. in diameter, in two resilient bearings connected to vibration indicators consisting of a coil inserted in the air-gap of a permanent magnet. When an unbalanced object is rotated in the bearings at a constant speed, the bearings will vibrate, setting up sine-wave alternating voltages proportional to the vibrations.

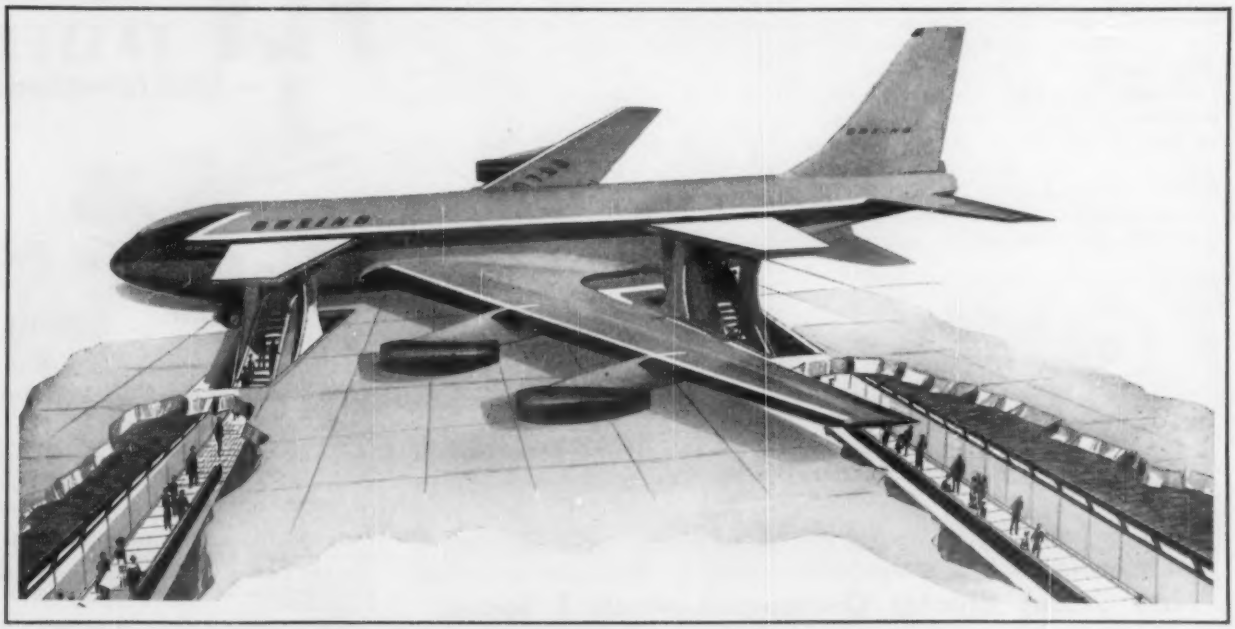
Approximate price is $8,707, f.o.b. Stockholm. U. S. representative of the firm is Ericsson Corp., 100 Park Ave., N. Y. 17, N. Y.

Readout System Samples Up to 200 Pressures

Operators of aircraft windtunnels, aircraft and automotive engine test facilities, model basins and the like, where large numbers of pressures must be accurately measured and recorded simultaneously, are offered a new multiple pressure readout system that can sample up to 200 pressures at one time with an accuracy of one part in 2,000 or higher.

The device, called the Press-I-Cell Logger, also automatically converts pressure magnitudes into digital form for recording in a typewritten column log and as a punched tape.

Output can be fed directly to computers or card punch equipment without the intermediate tape storage of data, when the typed log is not needed. Readout cycle (from pressure sensing to typed log and punched tape) takes a little more than one minute and the



New Approach to Transport Loading

This interesting proposal for an under-apron passenger loading ramp shows how two sections of the apron rise with integrally built moving stairs. Raised apron sections form umbrellas over the passengers to protect them from the weather as they enter plane. When lowered, sections become part of the airport loading ramp. Passenger facilities include two moving stairways. One, a horizontal conveyor, takes passengers from waiting area (lower left) to a stairway which passengers use to board the airplane ahead of the wing. Deplaning passengers may simultaneously take a moving stairway from the aft end of the plane. The artist's conception, using the Boeing 707 as a model, was originated by Esso Oilways; drawing is by J. McArdle.

from VACUUM MELTING–
improved alloys with exceptional properties

WHAT ARE VACUUM-MELTED METALS?

Vacuum-melted metals are a familiar family of alloys with new, improved characteristics. For during high-vacuum melting, gaseous impurities are literally sucked from the molten metal. The result is cleaner, purer metals with desirable properties not previously attainable . . . in, for example, superalloys, bearing steels, high-strength steels, electronic metals, or magnetic alloys.

WHAT ARE THEIR ADVANTAGES?

Many characteristics of a specific alloy can be improved by vacuum melting and casting . . . for impurities that limit an alloy's potential are removed. Tensile and impact strength, stress rupture strength at elevated temperatures, and fatigue life can all be substantially improved . . . and creep and brittleness minimized by vacuum melting.

HOW CAN I BEST USE THESE IMPROVED ALLOYS?

Frankly, vacuum-melted metals are so new that many applications for them have not yet been explored. But where they have been used, they've *proved* their effectiveness in improved performance. Superalloy jet engine turbine blades, for example, have given more than *twice* the performance life of blades made of conventional air-melted alloys. And ball bearing rejects dropped from 50% to 3% when vacuum melted steels were used.

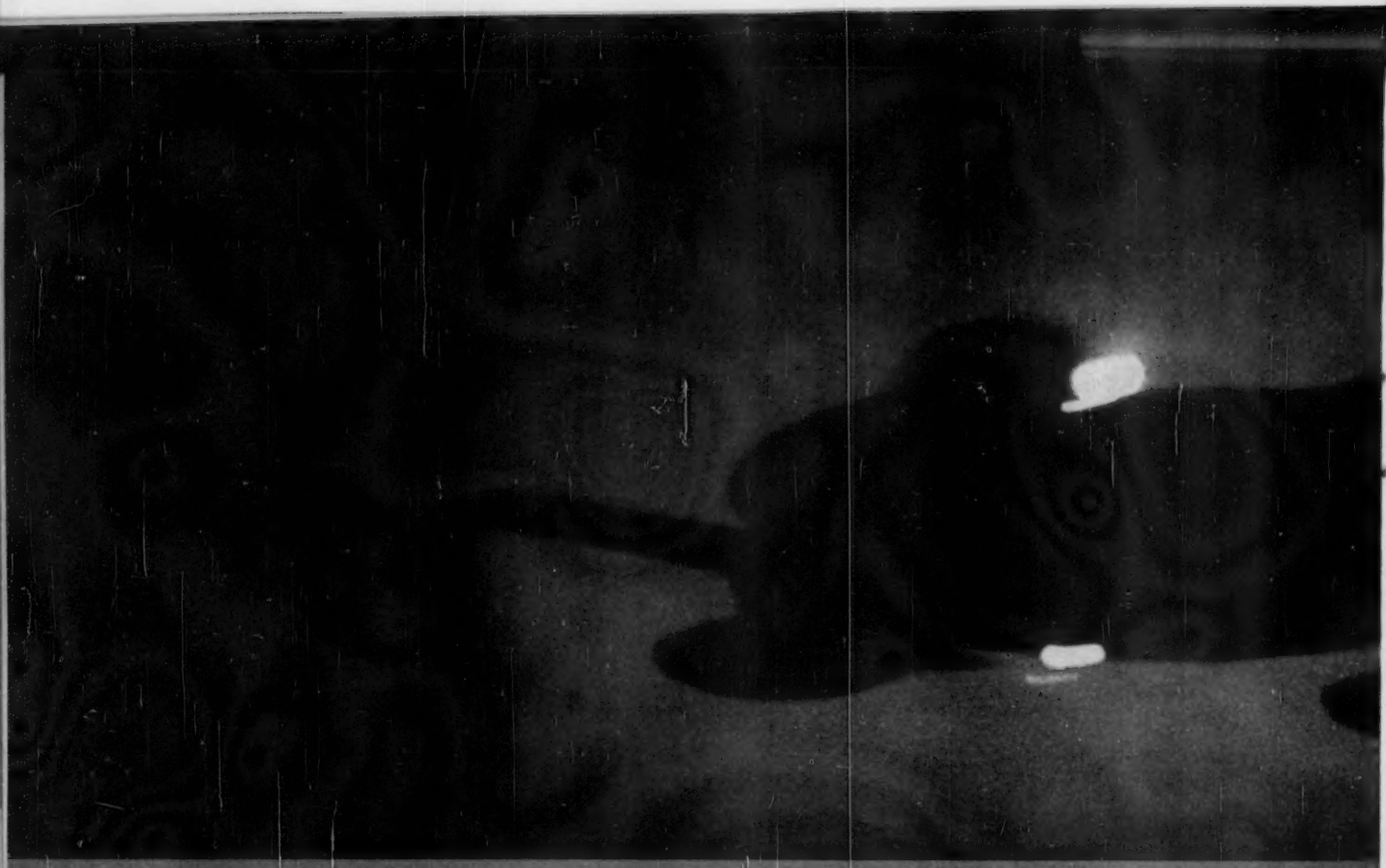
WHERE CAN I GET VACUUM-MELTED METALS?

Now, Vacuum Metals Corporation, pioneer in the development and production of vacuum-melted and cast alloys, is producing tool, high-speed, stainless and alloy steels – in most sizes and grades – as well as special ferrous and nonferrous alloys. If you have a metals problem that vacuum-melted alloys might solve, please describe it in as much detail as possible. Write *Vacuum Metals Corporation, P. O. Box 977, Syracuse 1, N. Y.*

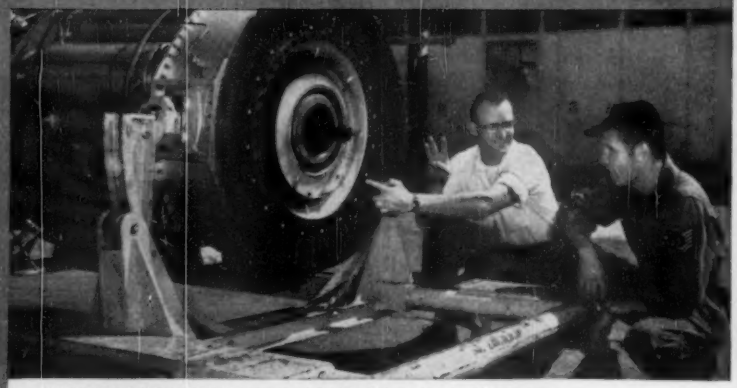
VMC

VACUUM METALS CORPORATION

Jointly owned by Crucible Steel Company of America and National Research Corporation

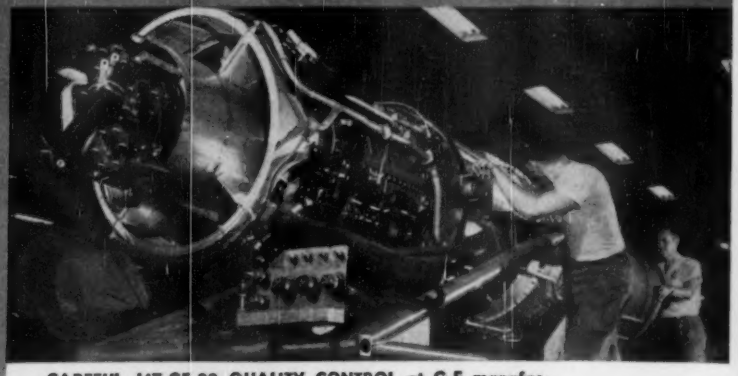


NEW INLET GUIDE VANES allow more air to enter compressor of J47-GE-33 engine. New vanes have same configuration as those used on J47-GE-17, but pay off in increased thrust during dry and afterburner operation.



IMPROVED RELIABILITY in the J47-GE-33 engine is illustrated by the new "floating" shim shroud visible above. It reduces the possibility of shroud ring rub on turbine wheel buckets. G-E tech rep is pointing to new adjustable turbine baffle.

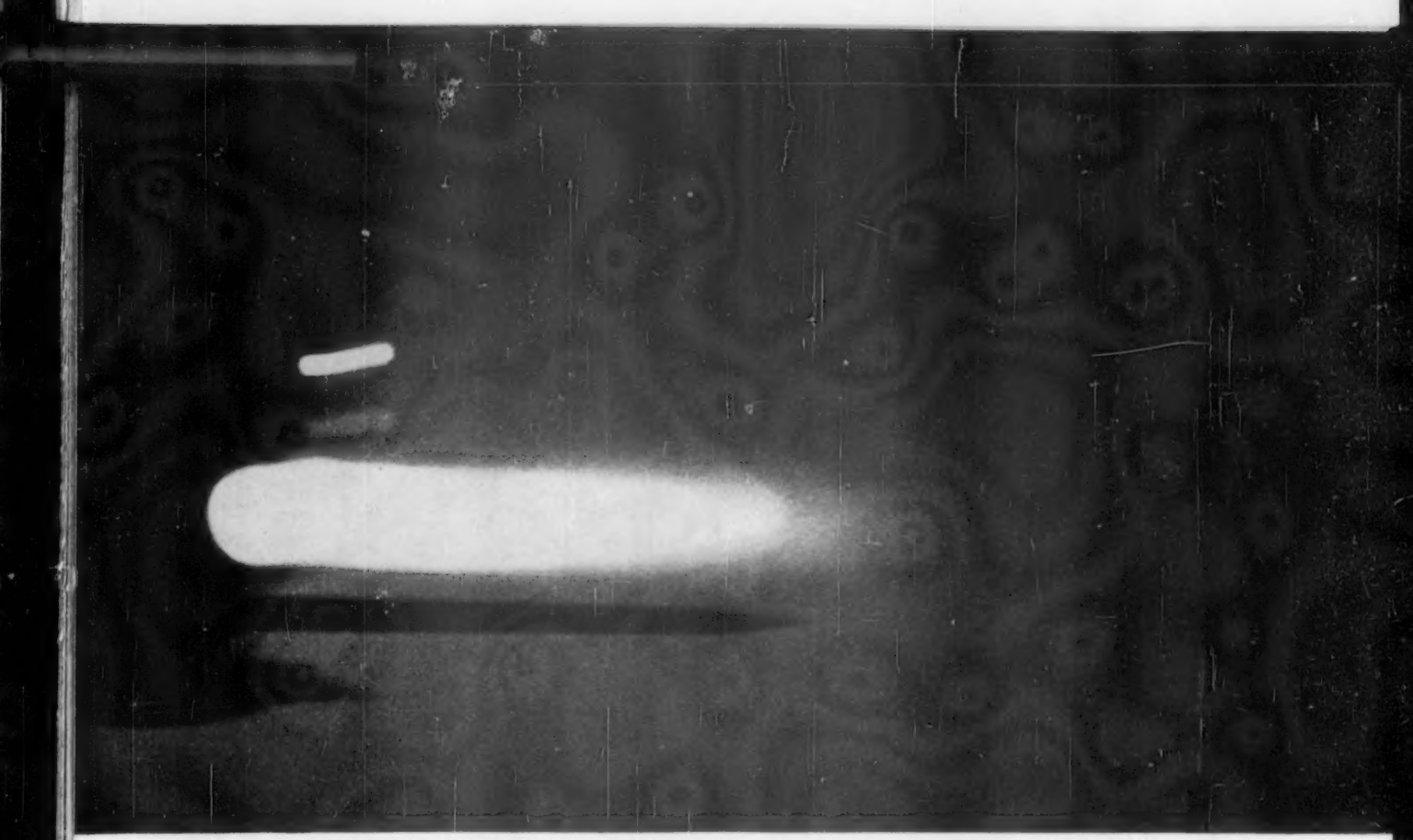
NEW, LARGER "EYELID" handles increased J47-GE-33 airflow. Just inside 'lid, a sturdy ceramic-coated liner acts as a radiation shield, allows higher afterburner fuel flow; also preserves boundary layer cooling of the tailpipe.



CAREFUL J47-GE-33 QUALITY CONTROL at G-E manufacturing plants is already paying dividends to the Air Force. For example, only one-out-of-four J47-GE-33's now require two tests before shipment to the USAF.

KEARFOTT

equipment is then instantly ready to



More "D" Sabre Jets are in use today than all other types of USAF interceptors combined.

Why the F-86D Sabre Jet Interceptor Now Climbs UPSTAIRS....20% FASTER!

New production model J47-GE-33 jet engine packs more thrust, also improves "D" reliability and ease-of-maintenance

For the past three years, North American Aviation's F-86D Sabre Jet has been the fastest interceptor in the Air Force's Air Defense Command (top speed: over 650 mph).

Today a new General Electric turbojet, the J47-GE-33, is being installed in "D" Sabres. The engine makes the "D" still faster . . . more reliable . . . easier to maintain.

The J47-GE-33 has the same basic design as its predecessor, the J47-GE-17. But these six improvements reduce its weight, increase its durability, and, most important, allow it to swallow more air and increase its afterburner power:

1. New inlet guide vanes
2. New capacitor discharge engine ignition system
3. New "floating" turbine wheel shim shroud
4. New Hotstreak afterburner ignition system
5. New ceramic inner-liner for afterburner
6. New larger variable area jet nozzle

The J47-GE-33 can peel 20% off the time originally required to "scramble" an F-86D from standing start to 45,000 feet.

By helping the Air Force reduce maintenance time and costs, as well as increase jet performance, the J47-GE-33 again illustrates the G-E slogan, "Progress is our most important product." *Section 232-3, General Electric Co., Schenectady 5, N. Y.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

KEARFOTT...

from problem through production

Engineering ability and production facilities are as important to you as the characteristics of the components you select. After components are approved, you are dependent upon your supplier . . . dependent upon him for engineering assistance . . . dependent upon his ability to produce quality products in the required quantities.

Many of the servo motors, synchros, gyros and systems in use today had their inception on the drafting boards of Kearfott's engineers. This is proof of Kearfott's engineering ability. Kearfott offers complete engineering service before, during and after the purchase of a component.

A modern building, over 430,000 square feet of floor space, equipped with the latest in precision machinery, manned by 3,000 highly skilled specialists, is your assurance of Kearfott's ability to produce.

Yes, Kearfott is a dependable source of supply. If you have a design problem or require a special or standard component, contact Kearfott.

KEARFOTT COMPONENTS INCLUDE:

Gyros, Servo Motors, Synchros, Servo and Magnetic Amplifiers, Tachometer Generators, Hermetic Rotary Seals, Aircraft Navigational Systems, and other high accuracy mechanical, electrical and electronic components.

Send for bulletin giving data of components of interest to you.

Kearfott

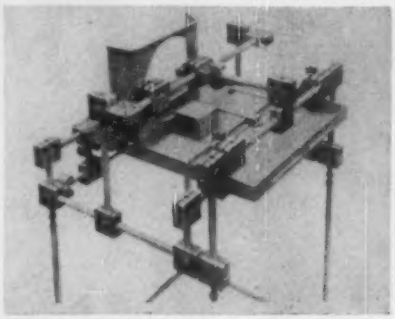
A SUBSIDIARY OF GENERAL PRECISION EQUIPMENT CORPORATION

KEARFOTT COMPANY, INC., LITTLE FALLS, N. J.

Sales and Engineering Offices: 1378 Main Avenue, Clifton, N. J.
Midwest Office: 188 W. Randolph Street, Chicago, Ill. South Central Office: 6115 Denton Drive, Dallas, Texas
West Coast Office: 253 N. Vinedo Avenue, Pasadena, Calif.

equipment is then instantly ready to begin the next cycle. Shorter readout cycles are possible, the manufacturer states.

Fischer & Porter Co., 269 Jacksonville Rd., Hatboro, Pa.



SIZE of Unitube fixtures is unlimited.

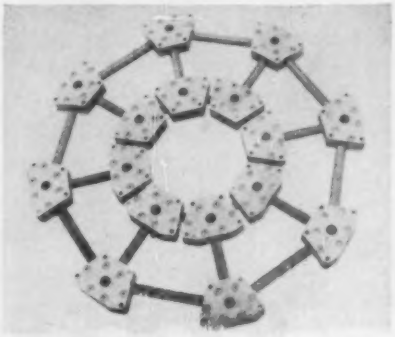
Unitube System Speeds Jig Fixture Building

The photos above and below show a companion to the Wharton Universal Jig and Fixture System that has been introduced in the American market. The new production aid is the Unitube System. It is marketed by Wharton and Wilcocks of America, Inc.

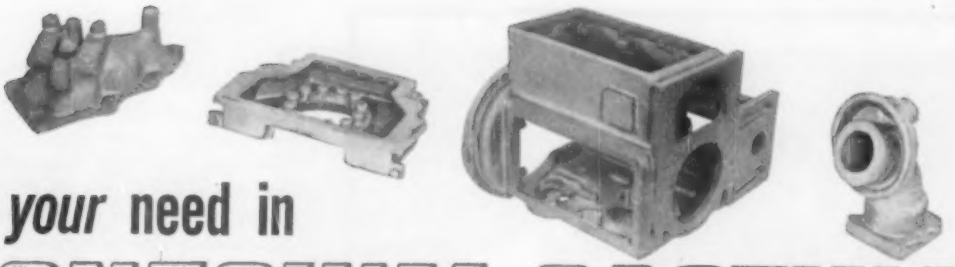
Developed for such operations as welding, assembly and pipe setting fixtures, it can be used for drilling and large machinery jigs. The company claims that there is no limit to the size of structures that may be erected nor to the uses they are designed for. It is claimed that tools for welding procedures, for instance, may be produced in two to four hours instead of 40 to 60 hours. The parts may be disassembled when the production run is completed, and later used again in different combinations.

Unitube consists of high-tensile octagonal tubing drawn to prescribed tolerances. Octagonal shape is used to give definite location to attached parts and eliminate slippage. The bores in the elements are also octagonal.

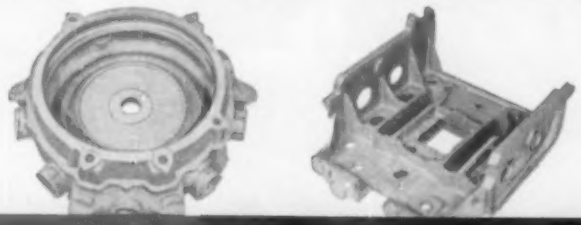
Basic Unitube set consists of 323 elements and 500 ft. of octagonal tubing. The company claims that cost of Unitube system is recovered in the form



BASIC UNITUBE has 323 parts plus tubing.



What's *your* need in MAGNESIUM CASTINGS



WHATEVER YOUR NEED . . . CALL ON

Bendix FOUNDRIES

for better quality and faster service

No matter how complicated your magnesium castings are . . . no matter what their size or shape . . . chances are that you can get better quality and faster service by dealing with us.

You save time and money with Bendix Foundries. We have a quarter century of specialized experience in the production of high-precision castings . . . of *all* magnesium and aluminum alloys.

You get what you want with Bendix Foundries. We utilize the most advanced service, methods and equipment . . . including resident government inspectors, X-ray analysis and a completely conveyorized production line.

If ability to produce quality castings in a wide range of sizes, shapes and varieties . . . and in production or made-to-order lots . . . interests you, write us for full details.

BENDIX FOUNDRIES

ECLIPSE-PIONEER DIVISION Bendix AVIATION CORPORATION **TETERBORO, N. J.**

West Coast Office: 117 E. Providencia Ave., Burbank, Calif.
Export Sales: Bendix International Division, 205 E. 42nd St., New York 17, N. Y.

Check-Chart Shows Versatility of Bendix Foundries

PROCESS USED	METAL WORKED	
	ALUMINUM	MAGNESIUM
Sand	√	√
Plaster	√	√
Shell Mold	√	√
Die	√	√
Permanent Mold	√	√

FREE . . . "Book of Facts"!

Please send me your "Book of Facts" on magnesium and aluminum castings.

Name _____

Title _____

Company _____

Street _____

City _____ Zone _____

State _____

Every 10 subscriber copies deliver 14 readers who really read

AVIATION WEEK

A McGRAW-HILL PUBLICATION

That's more than 66,000 bona-fide readers for a typical issue of AVIATION WEEK* . . . 1.4 readers per copy who passed a stiff recognition test . . . *readers who can prove they really read!*

Advertising Research Foundation uncovered this fact and a host of others about how AVIATION WEEK is read — how editorial material is read — how advertisements are read — how readers influence purchasing — in Study Number Six, The Continuing Study of Business Papers, just released. Together they make up one of the most impressive stories ever told about readership in the aviation industry.

This study was conducted by Advertising Research Foundation, because of its industry-wide importance, on behalf of some 190 leading advertisers, agencies and media — including the American Association of Advertising Agencies and the Association of National Advertisers — which compose the Foundation's membership. Findings were secured through methods developed and tested by ARF during two years of experimental research and used in actual studies of five other leading business publications. Because of these painstaking procedures and their absolute freedom from bias, Advertising Research Foundation studies are considered to be the most valuable research on magazine readership available today.

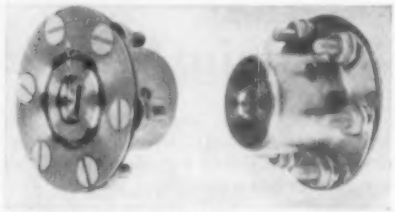
Your AVIATION WEEK representative will be glad to give you full details.

*Paid circulation of the issue studied by ARF (April 5, 1954) was 47,375. Paid circulation of current issues exceeds 50,000, on this same basis delivering *more than 70,000 readers who really read!*

McGraw-Hill Publishing Company, Inc., 330 West 42 Street, New York 36, N. Y.: Other Advertising Sales Offices: Atlanta 3, Ga., 801 Rhodes-Haverty Bldg. **Boston 16, Mass.,** 350 Park Square Bldg. **Chicago 11, Ill.,** 520 N. Michigan Ave. **Cleveland 15, Ohio,** 1510 Hanna Bldg. **Dallas 1, Tex.,** First National Bank Bldg. **Detroit 26, Mich.,** 856 Penobscot Bldg. **London E. C. 4, England,** 95 Farringdon Street. **Los Angeles 17, Calif.,** 1111 Wilshire Blvd. **Pittsburgh 22, Pa.,** 738-9 Oliver Bldg. **Philadelphia 3, Pa.,** 17th and Sansom Streets. **San Francisco 4, Calif.,** 68 Post Street. **St. Louis 8, Mo.,** Continental Bldg.

of saved man-hours after 35 to 50 set-ups.

Company's address: 17 Battery Pl., New York 4, N. Y.



STAINLESS steel valve mounts flush.

Small Valve Drains Water From Aircraft Fuel Tank

A new valve, designed for rapid draining of water from aircraft fuel tanks, has been developed by Steel Products Engineering Co.

Valve is self-closing, is positive in operation and uses a replaceable O-ring. It mounts flush with the wing's surface and its thin flange is built to individual customer requirements. It is made of stainless steel. Diameter is 2⅞ in., depth is 1½ in.

Address: Springfield, O.

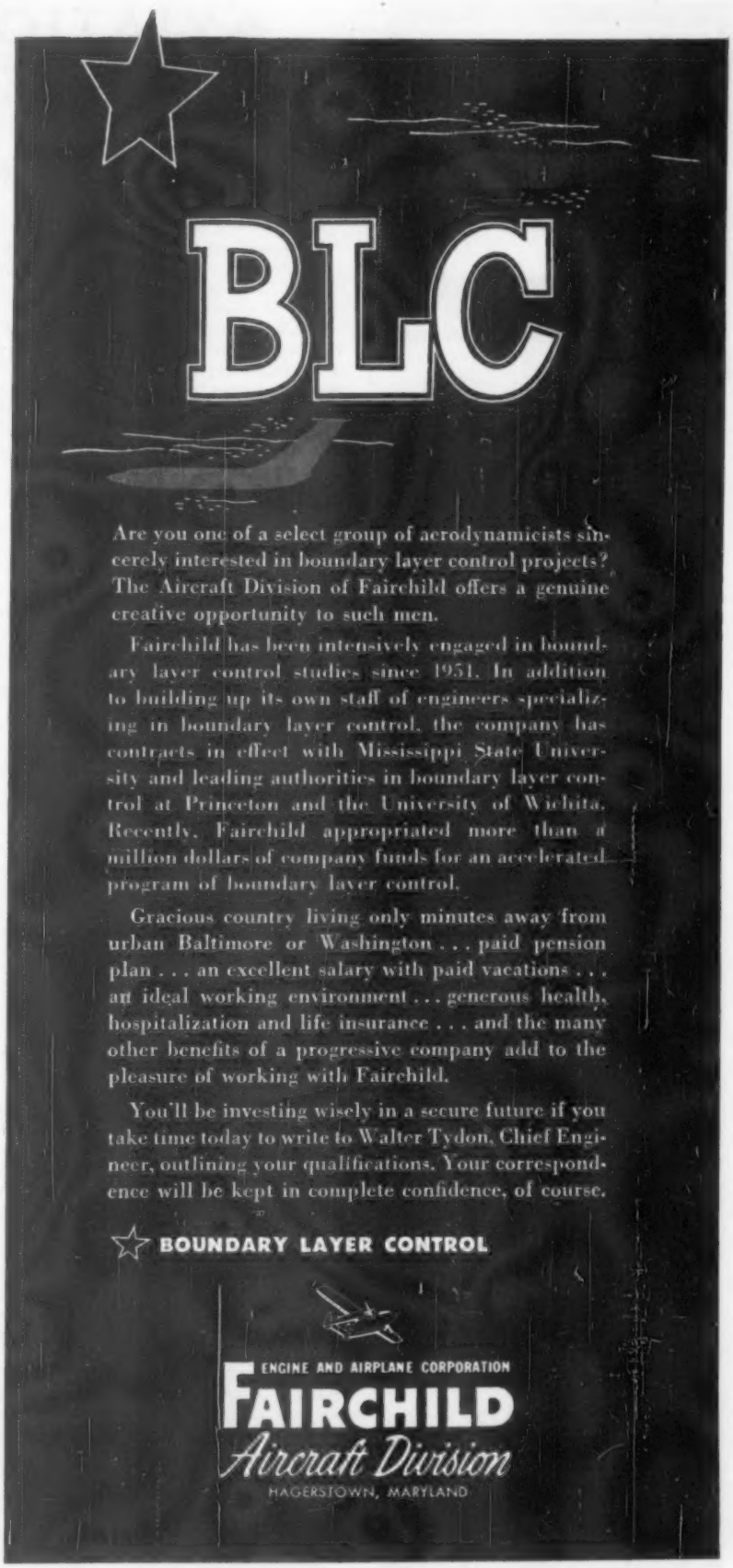
ALSO ON THE MARKET

Wire stripper works to within ⅛ in. of component and is adaptable to use on coils similar to choke coils. End of wire is inserted in device and withdrawn; there are no pedals or levers to operate. Model L-1 costs $100 f.o.b. Syracuse, N. Y. or $11 for one-month trial.—Eraser Co., Inc., 1068 S. Clinton St., Syracuse, N. Y.

Lightweight safety belt features a buckle stated to be 27% lighter than current types, having a special cam action increasing holding strength, yet giving less wear and being instantly releasable. —Brown-Line, Inc., 341 North Foothill Road, Beverly Hills, Calif.

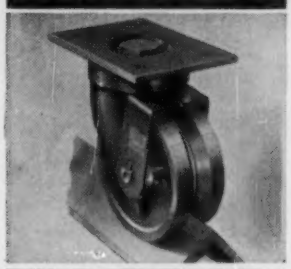
Non-heat-treatable electrode for steel parts subjected to high heat—impact and corrosion, can be work-hardened to over 180,000 psi. tensile strength. Hardness is 200 Brinell. Designation: All-State No. 275 chrome-nickel (ac-dc). Available in ⅛-in., ⅛-in., ⅛-in. and ⅛-in. core sizes in packages of 5 lb.—All-State Welding Alloys Co., Inc., 249-55 Ferris Ave., White Plains, N. Y.

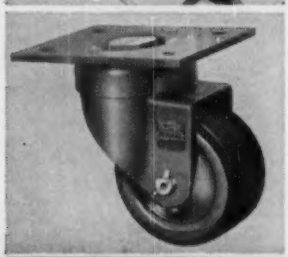
Ram-head milling machine combines a conventional spindle and self-contained motorized sliding ram for adjustable cutting heads, permitting horizontal and vertical spindles to be run separately and simultaneously—Kearney & Trecker Corp., Milwaukee 14.


BLC
Are you one of a select group of aerodynamicists sincerely interested in boundary layer control projects? The Aircraft Division of Fairchild offers a genuine creative opportunity to such men.
Fairchild has been intensively engaged in boundary layer control studies since 1951. In addition to building up its own staff of engineers specializing in boundary layer control, the company has contracts in effect with Mississippi State University and leading authorities in boundary layer control at Princeton and the University of Wichita. Recently, Fairchild appropriated more than a million dollars of company funds for an accelerated program of boundary layer control.
Gracious country living only minutes away from urban Baltimore or Washington . . . paid pension plan . . . an excellent salary with paid vacations . . . an ideal working environment . . . generous health, hospitalization and life insurance . . . and the many other benefits of a progressive company add to the pleasure of working with Fairchild.
You'll be investing wisely in a secure future if you take time today to write to Walter Tydon, Chief Engineer, outlining your qualifications. Your correspondence will be kept in complete confidence, of course.
BOUNDARY LAYER CONTROL
ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
HAGERSTOWN, MARYLAND

Rugged Stability!
helps you cut Costs

DARNELL





CASTERS

RUBBER TREADS . . . a wide choice of treads suited to all types of floors, including Darnelloprene oil, water and chemical-resistant treads, make Darnell Casters and Wheels highly adapted to rough usage.

RUST-PROOFED . . . by the Udylite process. Darnell Casters give longer, care-free life wherever water, steam and corroding chemicals are freely used.

STRING GUARDS . . . Even though string and ravelings may wind around the hub, these string guards insure easy rolling at all times.

LUBRICATION . . . all swivel and wheel bearings are factory packed with a high quality grease that "stands up" under attack by heat and water. Zerk fittings are provided for quick grease-gun lubrication.

DARNELL CASTERS & WHEELS
Always SWIVEL and ROLL

DARNELL CORPORATION, LTD.

DOWNEY (LOS ANGELES COUNTY) CALIFORNIA
60 WALKER STREET, NEW YORK 13, NEW YORK
36 NORTH CLINTON STREET, CHICAGO 6, ILLINOIS

AVIATION SAFETY

CAB Report on Continental Convair Accident Emphasizes . . .

Parts Catalog Not for Maintenance

THE ACCIDENT

At approximately 0840[1], Mar. 16, 1954, a Continental Air Lines Convair 340, N 90853, made an emergency wheels-up landing in a barren field about two and one-half miles northeast of the Midland Air Terminal, Midland, Tex. The accident occurred immediately following takeoff. There were no fatalities but serious injuries resulted to two of the eight passengers and minor injuries to several other passengers and the three crew members. The aircraft received major damage.

HISTORY OF THE FLIGHT

Continental Air Lines' Flight 46 of Mar. 16, 1954, was a daily scheduled flight between El Paso, Tex., and Kansas City, Mo., with intermediate stops, one of which was Midland, Tex. The crew, assigned at El Paso for the entire operation, consisted of Capt. Herbert E. Persing, First Officer Robert B. Bauer and Hostess Patricia A. Williams.

The first officer prepared an IFR (Instrument Flight Rules) flight plan according to company regulations although the weather conditions were forecast to be clear over the route at flight altitude.[2] The flight was dispatched by the company and following a walk-around inspection by the crew, the flight departed on schedule at 0610. Over the first segment, Trip 46 was uneventful and it arrived at Midland at 0821. This stop was for passenger changes only; therefore, the crew remained on board and the aircraft, having apparently operated normally, did not receive attention.

At 0833, Trip 46 was cleared to Runway 10 for takeoff. At this time the aircraft carried 585 gallons of fuel and was loaded to a gross takeoff weight of 36,345 lb., which was 10,655 lb. less than the maximum allowable. The load was properly distributed so that the center of gravity of the aircraft was within the approved limits. A pre-takeoff check was conducted adjacent to Runway 10 at which time the propellers, engines and instruments gave normal indications. A part of this check included moving the control column fore and aft and turning the wheel left and right in order to check the control system for freedom of movement and full travel.

At 0838 the flight was cleared for takeoff, which was made using normal takeoff power. Immediately after becoming airborne the crew noted a slight vibration which was attributed to an unbalanced condition of the spinning main landing gear wheels. Captain Persing applied brakes during the landing gear retraction to eliminate this vibration; however, it not only continued but rapidly increased in severity.

The aircraft reached an altitude of approximately 75 feet, the highest attained, and was near the airport boundary when the vibration stopped with a sudden jolt and the aircraft assumed a nose-down attitude. The first officer immediately sensing the situation joined the captain and both exerted their entire strength applying back pressure to their respective control columns to keep the aircraft from plunging into the ground. The captain quickly reduced power; however, the nose-down pressure could not be completely overcome.

The first officer used nose-up trim control in an effort to relieve the nose-down pressure; this action had no appreciable effect and during the last attempt the trim tab control wheel appeared to be stuck. The captain established a shallow left turn with the thought of returning to the airport and continued the turn about 45 degrees from the takeoff heading.

As air speed decreased power was momentarily increased whereupon it became evident to the crew that using power sufficient to maintain flight resulted in an insurmountable nose-down pressure. The captain therefore decided to make a wheels-up landing straight ahead. Close to the ground the first officer closed the throttles and the captain pulled the electrical crash bar. Contact with the ground followed with the aircraft in a near-level attitude and at approximately 100 mph.

Although the passengers and crew received injuries of varying degrees, they were able to get out of the aircraft unassisted in an orderly manner. The evacuation was mainly through the rear service door (emergency exit) and was accomplished in about 30 seconds. There was no fire.

INVESTIGATION

The investigation established that the aircraft first contacted the ground in a nearly straight and level attitude on a magnetic heading of 55 degrees. While sliding 1,200 feet the aircraft turned on its vertical axis and slid sideways before coming to a stop on a magnetic heading of 310 degrees. The left wing was sheared along a line near its fuselage attachments. This wing was located approximately 200 yards beyond the first ground contact point in a severely damaged condition. The left engine was torn from its mount and was found beyond the left wing and behind the main portion of the aircraft. The left horizontal stabilizer was crushed upward as the aircraft passed over the severed wing and remained attached only by the elevator torque tube. The fuselage and right wing were buckled.

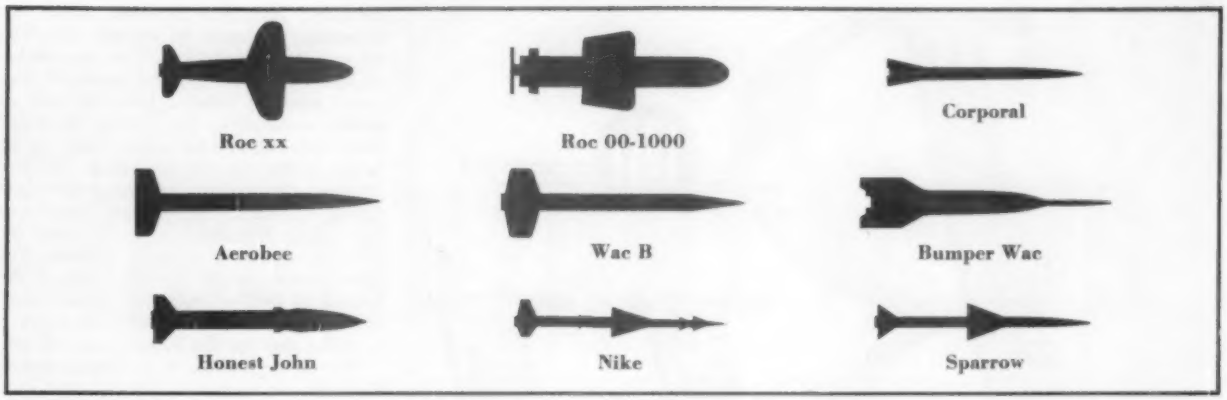
Examination of the right horizontal stabilizer and elevator revealed no external damage; however, it was noted the right elevator trim-servo tab was jammed in a 24-degree up or aircraft nose-down position.

There were over-travel marks and notching found on the leading edge skin of the tab at its hinge points. The access door on

---

[1]All times herein are Central Standard Time unless otherwise indicated and are based on the 24-hour clock.

[2]Weather was no factor in this accident.



Missiles by DOUGLAS

A box score of 15 years continuous participation in designing and building guided missiles for the Air Force, Army and Navy

Already key cities have the protection of a guided missile which can destroy the swiftest stratospheric bombers. This is Nike, *operational* result of long and versatile missile experience.

Douglas association with rockets and guided missiles has seen this company at work with other industrial leaders and our Armed Forces—to move missile development from a dream of push-button warfare to a solid reality. You saw it in the Bumper Wac research rocket, world altitude champion, in Honest John—field artillery rocket with high explosive or atomic wallop—in missiles of every type . . . air to air . . . air to ground . . . ground to ground . . . ground to air.

Douglas leadership in rocket airframe design has helped give us *operational* missiles in a relatively short span of time. Security cloaks even greater advances which are now on the way.

Depend on *DOUGLAS* First in Aviation

B·H

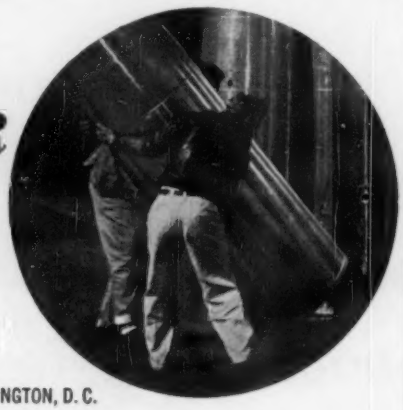
fabricators for the aircraft industry

B.H. AIRCRAFT CO. INC.
FARMINGDALE, NEW YORK

FLETCHER

builds good tanks fast

PASADENA, CALIFORNIA DAYTON, OHIO WASHINGTON, D. C.



the lower horizontal stabilizer surface was immediately opened to examine the trim tab actuating mechanism. This examination disclosed that the forward push-pull rod, which normally extends from the jack assembly rearward to the elevator hinge-line idler, had failed. The failure occurred adjacent to the rear rod-end fitting. The free stub end attached to the idler was wedged against the bottom edge of the elevator spar cutout hole in such a manner as to hold the trim tab rigidly in a full-up position. The idler showed an interference mark at the base of its fork to which the forward push-pull rod was attached and this mark matched a similar one on the failed push-pull rod.

The failure resulted from tension around the sides and bottom of the rod and compression at the top. Matching the fractured ends revealed a set of approximately one-eighth inch due to downward bending before failure. All other components of the assembly were undamaged

A comparison of the assembly, as installed, with the appropriate Convair drawing disclosed both the idler and the forward push-pull rod were installed in reverse. Interference between the idler and push-pull rod was caused by the reversed idler.

Company maintenance records showed the right elevator trim tab assembly had been removed, reinstalled and inspected by company maintenance personnel. This work was done during a No. 3 check, 14:40 flight hours prior to the accident, for the purpose of removing excessive play from the assembly. During the reassembly and reinstallation both the Company Convair Maintenance Manual and the Manufacturers Illustrated Parts Catalog were used as references.

Figure 7.4.101 of the Maintenance Manual, entitled "Elevator Tabs Installation," was first referred to during the installation. This figure illustrated the idler as a straight-designed component whereas the actual part is curved, and depicted the forward and rear push-pull rods incorrectly in their inboard and outboard relationship. Instructions 7.4.2 and 7.4.3 of the same publication referred to this figure for removal and installation purposes. From this figure, 7.4.101, correct positioning of the idler could not be determined.

In order to determine which way the curved idler should face in the assembly the maintenance personnel involved used as a reference Figure 2003 of the Manufacturers Illustrated Parts Catalog entitled "Elevator Trim Tab Idler Installation."

This figure illustrated an exploded view of the complete left-hand elevator trim tab idler assembly including its left idler. Since the right idler for the right elevator trim tab assembly was of different design than the left, it appeared alone and below the left assembly but on the same plate. It was shown curved which correctly depicted its actual design. Thus, for a right-hand assembly it was necessary to substitute the right idler in place of the left.

It was stated by the company that by conventional interpretation of this illustration the left assembly would be correctly installed in the aircraft and the left idler correctly installed in the assembly; however, upon substituting the right idler as required for the right assembly and following the same conventional interpretation of the figure, the result would be, and was, a reversed

IMPORTANT NEWS TO THE AVIATION INDUSTRY

KAISER ALUMINUM NOW PRODUCES

Erie forging plant will provide the aircraft industry with continuing supply of high quality forgings plus nationwide service

RECENTLY we acquired one of the nation's three major aluminum forging plants on a long term lease. The plant is located on a 57-acre site in Erie, Pa.

This modern, diversified plant, built in 1943, has long been known for the high quality of the aluminum forgings produced. Forging equipment includes a wide variety of hammers and presses fully complemented by engineering, die sinking, laboratory, and inspection facilities.

The Erie plant produces aluminum die forgings from the smallest size up to 150 pounds as well as hand forgings up to 700 pounds. It has a rated capacity of 12 to 15 million pounds per year.

The plant is manned by highly skilled men with years of experience in aluminum forgings for aircraft.

Better service for the aircraft industry

For years we have been a major supplier of aluminum in many forms to aircraft manufacturers. The acquisi-

Setting the pace . . . in growth, quality and service

FORGINGS

tion of the Erie plant makes it possible for us to bring important benefits to these customers.

Sales service—The addition of aluminum forgings to our wide range of mill products enables our nation-wide sales force to increase its service to our customers. Personal attention is given to every order from the time it is received until the forging is delivered to the customer.

Engineering service—We are increasing the present staff of experienced engineers. These men are highly skilled in die and forging design for the aircraft industry and are available for customer consultation.

Quality control—Trained laboratory personnel, using the most modern testing methods and equipment, assure highest quality forgings to meet the rigid specifications of the aircraft industry.

Production control—The most modern methods of production control are employed to expedite material flow, die making, forging and finishing operations, thus maintaining shipping schedules.

Another major step in Kaiser Aluminum Expansion

As the eleventh major Kaiser Aluminum plant, the Erie forging works will carry forward our program for further integration and diversification of operations and products.

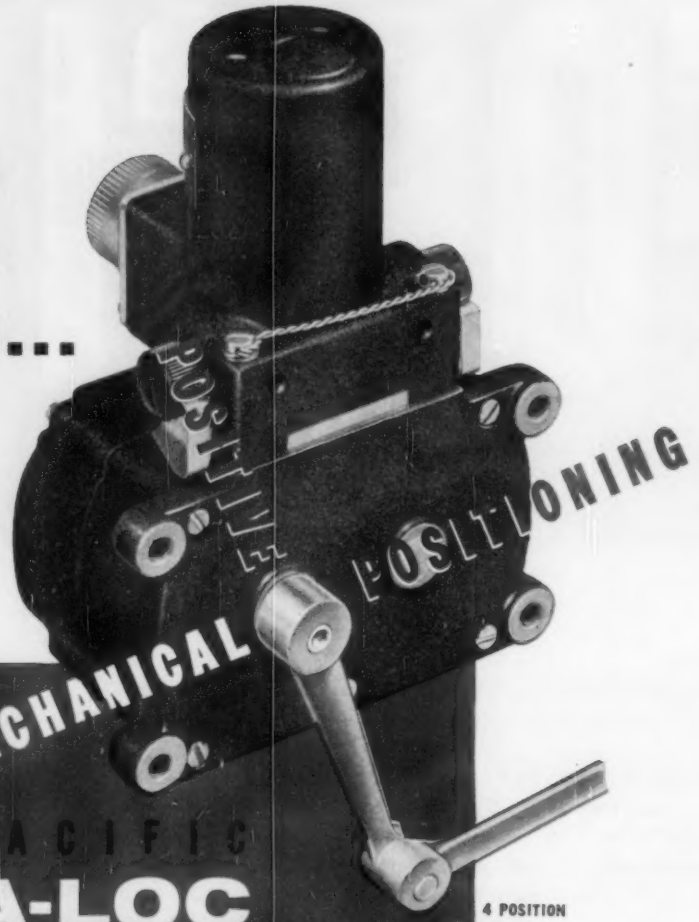
We have been producing forging stock at our rod, bar and wire plant at Newark, Ohio for a number of years. We will continue to supply the industry in addition to meeting our own needs for quality forging stock.

Our increased product diversity, greater production capacity and unsurpassed sales and engineering service, ideally equips us to work with the aircraft industry.

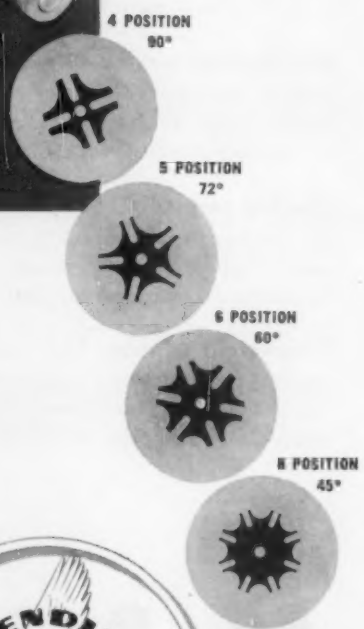
For immediate attention to your aluminum forging needs, contact any Kaiser Aluminum sales office listed in your telephone directory. Kaiser Aluminum & Chemical Sales, Inc. *General Sales Office,* Palmolive Bldg., Chicago 11, Illinois; *Executive Office,* Kaiser Bldg., Oakland 12, California.

Kaiser Aluminum

THE ACTUATOR WITH...



BENDIX-PACIFIC GENEVA-LOC ELECTRIC ACTUATORS



The exclusive Geneva cam action in these famous Bendix-Pacific Electric Actuators rotates the shaft to the exact position, then locks it against movement. This mechanically controlled positioning is completely independent of motor overtravel and all limit switches, brakes, clutches, etc., are eliminated. Geneva-Loc Actuators require no attention.

The high speed motor starts and stops at no load and the gear ratio is constantly variable, starting and ending at infinity, resulting in smooth starts, and stops and extended motor, gear and switch life. Geneva-Loc Actuators can be used to advantage on any installation where the positions are predetermined and if more than two, equally spaced. Ideal for valves and other controls. Standard units have travel increments of 45°, 60°, 72°, or 90°. Pacific Division Engineers are available to assist you.

Write for Bulletin 114

BENDIX PACIFIC

THE NAME Bendix AVIATION CORPORATION SPELLS TRUST

PACIFIC DIVISION • Bendix Aviation Corporation

11600 Sherman Way, North Hollywood, California

East Coast Office:	Dayton, Ohio	Washington, D. C.	Canadian Distributors:	Export Division:
475 5th Ave., N. Y. 17	1207 American Blvd., Dayton 2, Ohio	Suite 803, 1701 "K" St., N. W.	Aviation Electric, Ltd., Montreal 9	Bendix International 205 E. 42nd St., N. Y. 17

idler installation (the convex side forward instead of rearward).

Upon completion of the installation the mechanic told the inspector how he had installed the idler. The inspector referred to Figure 7.4.101 of the Maintenance Manual and Figure 2003 of the Parts Catalog, the same references used by the mechanic, and agreed with the mechanic's interpretation of the reference material. He then inspected the work and thought it was satisfactory. The assembly was functionally tested in accordance with prescribed procedures and the results were normal. Subsequent tests revealed that the normal indications would be obtained with the idler in reverse. Had the check procedure required the trim tab be moved through its travel with the elevator full-up, an interference would have been noted.

Figure 8.2.104 of the Maintenance Manual, commonly called the "rigging page," was not consulted during this installation or inspection. It was stated by company personnel that rigging was not involved and the figure did not include adequate installation and rem val instructions. The figure however did illustrate correct positioning of the idler.

During the public hearing it was stated by Convair representatives that the Illustrated Parts Catalog should not have been used as a reference during the right elevator trim tab installation. It was stated that this manual was solely published for identification of parts and associated purposes. It was also stated that a question involving installation, as in this case, should have been resolved by consulting the appropriate blueprint.

On the other hand, company witnesses stated that common practice throughout the industry was to use the Manufacturers Illustrated Parts Catalog as a guide during maintenance work and they expected it to correctly illustrate the relative position of parts in an assembly and in an aircraft. Thus, it was believed the Illustrated Parts Catalog was correctly used as an installation reference but because of the incorrect fore and aft depiction of the right idler it was installed in reverse. They further stated that blueprints were used primarily during modification work, were not available at outlying stations where maintenance was performed, were cumbersome, and it was questionable whether or not an average maintenance employee could read a blueprint effectively. For these reasons company officials believed a blueprint was not satisfactory as a routine maintenance or installation reference.

The Board, subsequent to the hearing, conducted a nationwide survey of approximately 70 maintenance bases owned and operated by scheduled and irregular carriers. Results indicated that approximately 65% of the operators did not consider the Manufacturers Parts Catalog as a maintenance reference and confined its use to an identification of parts only. The survey also revealed that aircraft manufacturers with one exception do not intend that their Parts Catalogs be used for any other purpose.

Investigation disclosed the blueprint of the assembly which was available at the time of the subject installation illustrated the right-hand view but was incorrectly

Introducing

FUSITE'S New

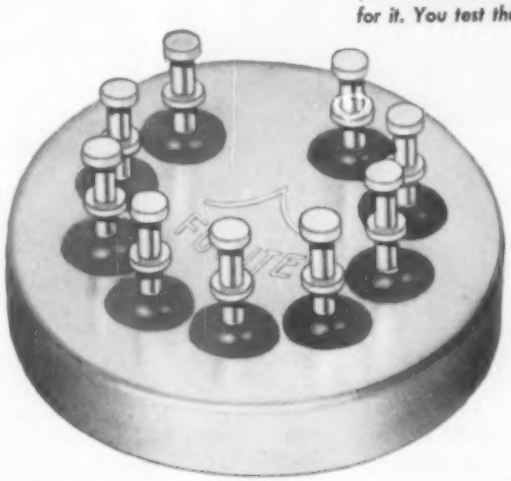
T.P.* Terminals

with

V-24 GLASS

* TORTURE-PROOF

(Don't take our word for it. You test them.)



Fusite's exclusive new V-24 Glass, developed in our lab., smelted right in our own plant is now permitting us to offer features in our entire line of hermetic terminals that we've long dreamed of, never 'til now realized.

Check these construction and performance features:

- ☑ 100,000 Meg. Ohms at 130° C.
- ☑ Extreme Resistance to Thermal and Mechanical Shock.
- ☑ Greatly Improved Flash-over.
- ☑ Hot Solder Dipped for Better Salt Spray Resistance and Easy Soldering.
- ☑ Stronger Low Expansion Alloy Pins in Light-weight Cap.
- ☑ Remain Leak-proof through Years of Use and Abuse. (Test 'em on Your Mass Spectrometer Leak Detector!)

Write Dep't. M-1 today for free samples for testing. Specify Fusite V-24 Glass.

FUSITE TERMINALS

THE FUSITE CORPORATION

6000 FERNVIEW AVENUE

CINCINNATI 13, OHIO

YOU CAN MAKE important savings whenever you need bellows or bellows assemblies—by calling upon Fulton Sylphon or Bridgeport Thermostat.

Our bellows application engineers are ready to help make your design problems easier and your products better. They'll recommend the right bellows metal . . . stainless steel, brass, monel or nickel. They'll know the correct bellows charge for the job . . . volatile liquid or gas. They'll help you in many more ways, to assure your having a bellows assembly exactly suited to your specifications. And, they're backed by half-a-century of experience, skilled production personnel and ample facilities—further assurance of time-and-money-savings for you.

Sylphon and Bridgeport bellows assemblies are used for thermostatic devices, pressure controls, hydraulic mechanisms, expansion joints and more applications.

Write for technical advice on your requirements. Ask for idea-filled Catalog AA-1400.

Robertshaw-Fulton
CONTROLS COMPANY

FULTON SYLPHON DIVISION
KNOXVILLE 1, TENNESSEE

BRIDGEPORT THERMOSTAT DIVISION
BRIDGEPORT 1, CONNECTICUT

labeled a left-hand view. The blueprint was also designated a plan view; however, to be read as such, it was necessary to hold it overhead or interpret it as if it were in such a position.

Immediately after Board investigators learned the cause of the failure in this accident, an accelerated inspection program was conducted on all Convair 340 aircraft. This was done in the interest of safety to insure that no others were in operation with the idler reversed. The manufacturer also took immediate measures to apprise all purchasers of these aircraft of the factual situation as well as corrective action if necessary. As a result of the inspections which followed, reports revealed that four Convair 340 aircraft were in service with reversed idlers. Two of them had no maintenance records relative to the assembly and were alleged to have been unaltered factory installations. One other aircraft was found with a forward push-pull rod bent evidencing a reversed idler installation some time prior to the inspection. The total flying time on these aircraft varied between 1,600 and 3,000 hours.

Company maintenance and inspection records relative to the aircraft and engines disclosed no other discrepancies and appropriate CAA directives had been complied with.

Investigation disclosed that all maintenance, inspection and flight personnel were currently certificated for their respective duties by the Civil Aeronautics Administration.

ANALYSIS

Immediately after the aircraft became airborne the crew noted a vibration which became more severe as air speed increased. It is very probable that this vibration was due to tab flutter which occured after the push-pull rod failed and the air flow over the horizontal tail surfaces increased to the crit-

Wire Service

Electric cable preparation time is cut with this new Douglas Aircraft machine which stamps identification number on electric wire, measures it to correct length, then cuts it, all in one operation. Eight of the machines, developed by Santa Monica Division employe, Glen Lydolph, are in use at Santa Monica and nine others are under construction for other plants.

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

Do you fit into this picture?

Opportunities in Guided Missile Engineering at North American Aviation:

ELECTRO-MECHANICAL

Microwave Antenna
Microwave Components
Radar
Computers
Fire Control
Servo-Mechanisms
Product Engineering
Standards Engineering
Technical Writing

AEROPHYSICS

Preliminary Analysis
Preliminary Design
Systems Analysis
Structures Engineering
Aeroelasticity & Flutter
Weight Engineering
Aerodynamics
Electrical Design
Flight Test Engineering
Flight Test Instrumentation

PROPULSION

Stress & Dynamic Analysis
Controls
Combustion Devices
Turbines & Pumps
Valves & Regulators
Field Test Engineering
Rocket Engine Instrumentation
Propellant Research
Missile Power Plant Systems

At North American you will use the nation's finest experimental and test facilities: subsonic, supersonic, and tri-sonic wind tunnels, thermodynamic laboratory, electro-mechanical laboratories, rocket engine field laboratory.

Many opportunities for recent graduates, and a number of high-level positions are available to experienced engineers. You are invited to send your resume to: North American Aviation, Incorporated, Engineering Personnel Manager—12214 Lakewood Boulevard, Downey, California.

organization, facilities and experience keep

North American Aviation, Inc.

years ahead in aircraft . . . atomic energy . . . electronics . . . guided missiles . . . research and development.

"GET 'EM ON THE RISE!"

TO ENGINEERS who are skilled in aerodynamics...or structural design...or flutter and dynamics... or electronics...or physics...or missiles control...or weapons systems, BEECHCRAFT may offer an opportunity that is quite superior to the average job opening.

BEECHCRAFT has long been known as the leader in the production of civilian and executive type aircraft. This market is now growing rapidly as the top businessmen all over the world begin to appreciate the increased financial returns made possible by company airplanes.

This corporation and executive market is a stabilizing influence on BEECHCRAFT's volume of production, which actually consists of a major portion of military work and a lesser portion of commercial work.

BEECHCRAFT is aggressively entering new fields and needs skilled engineers to do creative work of top-level quality in these fields. If you would like to be associated with a leading organization that is large enough to have diversification of product, but small enough to insure recognition of personal ability shown by those who have it, and if you do possess superior skills in the categories first mentioned, write to –

Beechcraft

Beech Aircraft Corporation,
Wichita, Kansas, U. S. A.

ical flutter speed for the free tab condition. As air speed built up, the oscillations increased in magnitude until the stub end of the failed rod became wedged, holding the trim tab in a full-up or aircraft nose-down position.

The trim tab position and the resulting nose-down pressure could not be overcome by the crew and necessitated the wheels-up landing which followed. The failure of the push-pull rod was caused by stresses imposed on it as a result of the reversed idler installation.

As shown under investigation, the Maintenance Manual was first consulted during the right elevator trim tab installation and Figure 7.2.101 of this manual was considered the appropriate reference. Since the figure did not illustrate correct positioning of the idler, nor were instructions clarifying its installation included, this part of the Maintenance Manual was inadequate.

Although rigging was not considered to be involved by the mechanic and inspector, it was closely related to this installation. When the idler installation question was referred to the inspector by the mechanic his experience and responsibility should have prompted him to refer to the "rigging page" (Figure 8.2.104 of the Maintenance Manual) in addition to the references previously mentioned. Had he done so the inspector should have realized that the idler was installed contrary to the rigging diagram, alerting him to the inconsistencies of the references.

The carrier is required by Civil Air Regulations to prepare and maintain a Maintenance Manual and it is responsible to determine that this manual is complete, current and adequate. The Illustrated Parts Catalog is not considered a part of, or supplement to, the Maintenance Manual. The Board therefore is of the opinion that the carrier did not meet its responsibility to determine adequacy of its Maintenance Manual and its policy permitting the use of the Parts Catalog as a maintenance guide was incorrect.

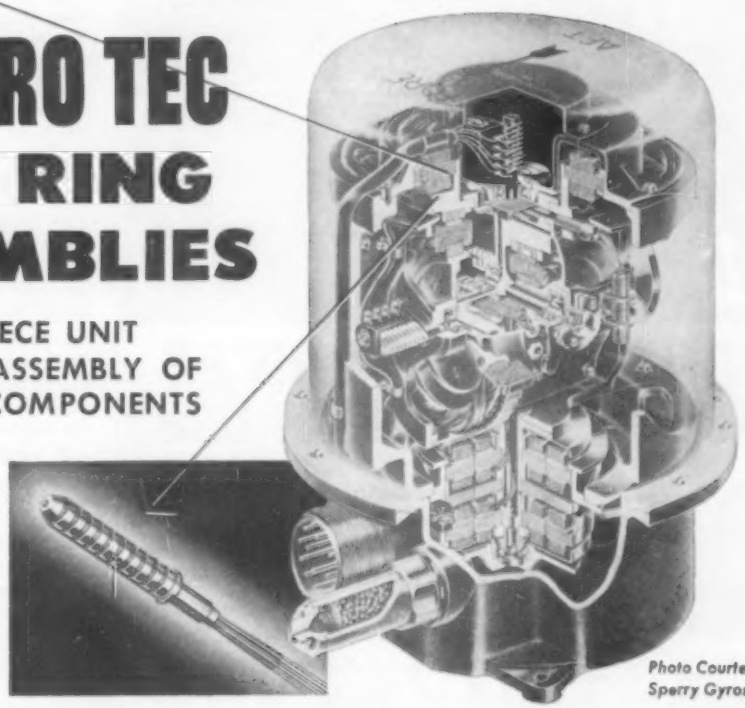
The public hearing revealed that other carriers have used the catalog as a maintenance guide. This practice indicates that in most instances the publication has been reliable for this purpose and leads to the conclusion that due to a mistake of the manufacturer in preparing Figure 2003 of the Parts Catalog, the right idler was shown with its convex side forward, or reversed relative to its correct installation. Although representatives of the manufacturer stated this publication was not intended to be used as a maintenance guide, it is evident the carrier was not aware of the publication's limited purpose.

As shown by the Board's safety survey, approximately one-third of the scheduled and irregular carriers have used Parts Catalogs as maintenance references although manufacturers have not prepared them for this purpose. The Board believes that the publication, unless specified by the manufacturer, should not be used for maintenance purposes and as a result, the Civil Aeronautics Administration has taken measures which will clarify the conflicting opinions relative to the proper use and purpose of the Illustrated Parts Catalog, emphasizing that it is not considered a maintenance

OPTIMUM PERFORMANCE IN VITAL AUTOMATIC PILOT SYSTEM

ELECTRO TEC
SLIP RING ASSEMBLIES

ONE PIECE UNIT REPLACES ASSEMBLY OF MULTIPLE COMPONENTS



The instrument shown is a Sperry "Gyrosyn" compass which combines the advantages of gyroscopic stability and magnetic correction to provide an accurate directional reference.

Photo Courtesy Sperry Gyroscope Company

Offering Closer Tolerances, Absolute Uniformity and the Ultimate in Miniaturization:

- ONE PIECE, UNITIZED CONSTRUCTION
- ABSOLUTE MINIMUM FRICTION TORQUE
- DIAMETERS FROM .035" to 36.0"
- MINIMUM 1000 V.A.C. HI-POT INTER-CIRCUIT
- HARD SILVER RINGS PLATED TO PRECISELY MACHINED ONE-PIECE PLASTIC FORM
- SPECIAL SURFACE DEPOSITS PREVENT TARNISH, MINIMIZE FRICTION, BRUSH NOISE AND WEAR

—featuring SUPER DEPENDABILITY!

The Sperry "Gyrosyn" compass is an outstanding example of precision and dependability. Electro Tec is proud to furnish slip ring assemblies which are consistent with the high accuracy and unfailing performance of this instrument. In this application, as in hundreds of others, Electro Tec meets specifications with a degree of accuracy unattainable with built-up or molding methods of manufacture. This extreme precision plus the many other advantages that result from Electro Tec manufacturing techniques have resulted in leadership throughout the industry. For complete co-operation in applying Electro Tec "know-how" to specific problems call or write the Sales Engineering Department.

Pat. No. 2696570

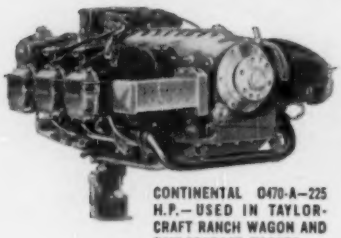
ELECTRO TEC CORPORATION

SOUTH HACKENSACK • NEW JERSEY

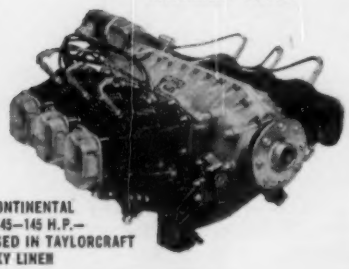
PRODUCTS OF PRECISION CRAFTSMANSHIP BY A NEW AND REVOLUTIONARY PROCESS •

The NEW All-Fiberglas TAYLORCRAFTS

Fly with CONTINENTAL POWER



CONTINENTAL O470-A—225 H.P.—USED IN TAYLORCRAFT RANCH WAGON AND TAYLORCRAFT TOPPER



CONTINENTAL C145—145 H.P.—USED IN TAYLORCRAFT SKY LINER

Continental Motors shares Taylorcraft's pride of achievement in the three new series of utility planes currently being introduced by this industry pioneer. Like most other leading makes of airplanes, Taylorcraft's new all-Fiberglas models—the Ranch Wagon, the Sky Liner, and the Topper—offer the proven safety, dependability and economy of Continental power. The fact that 50 per cent of Taylorcraft's 1955 production is destined for export provides an additional reason for standardizing on Continental power. For Continental aircraft engines are backed by established service facilities . . . trained mechanics and genuine Continental parts . . . all over the world, wherever people fly.

MEN WHO LOOK TO THE FUTURE LOOK TO THE AIR FORCE RESERVE

Continental Motors Corporation
Aircraft Engine Division
MUSKEGON, MICHIGAN

guide under Civil Air Regulations. The Board is of the opinion that this action taken by the Civil Aeronautics Administration is appropriate; however, the misuse of the Parts Catalog should have been noted sooner by the CAA through its assigned agents for more timely action.[a]

FINDINGS

On the basis of all available evidence the Board finds that:

1. The carrier, the aircraft and the crew were properly certificated.

2. The aircraft was loaded to a weight less than its maximum allowable for takeoff and its center of gravity was located within the approved limits.

3. The pre-takeoff checks performed at Midland indicated the engines, propellers, instruments and controls functioned normally.

4. Immediately following a normal takeoff the right elevator trim tab push-pull rod failed and the stub end became wedged, holding the trim tab in a full-up or aircraft nose-down position.

5. The trim tab position resulted in the crew being unable to control the aircraft and a wheels-up landing resulted.

6. The push-pull rod failed as a result of excessive stresses caused by interference resulting from a reversed idler installation.

7. The right elevator trim tab assembly was removed, reinstalled, inspected and functionally checked by company maintenance personnel 14:40 flight hours prior to the accident.

8. Correct positioning of the right idler component could not be determined from the Maintenance Manual figure, 7.4.101, which the carrier considered appropriate for the installation.

9. The Manufacturers Illustrated Parts Catalog was used in accordance with company policy as an installation reference to determine the idler position.

10. Under conventional interpretation of the appropriate exploded diagram of the Parts Catalog, the idler was installed in reverse.

11. The Illustrated Parts Catalog was not intended and should not have been used as a maintenance reference.

PROBABLE CAUSE

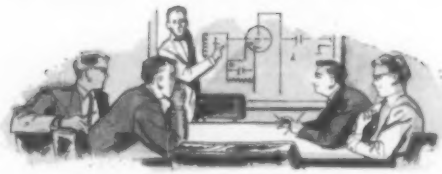
The Board determines that the probable cause of this accident was loss of control due to a failure of the right elevator trim tab push-pull rod caused by a reversed installation of the right elevator trim tab idler as a result of the carrier's reliance on the Manufacturers Illustrated Parts Catalog as a maintenance reference.

By the Civil Aeronautics Board:

Chan Gurney
Oswald Ryan
Josh Lee
Joseph P. Adams

(Harmar D. Denny, Vice Chairman, did not participate in the adoption of this report.)

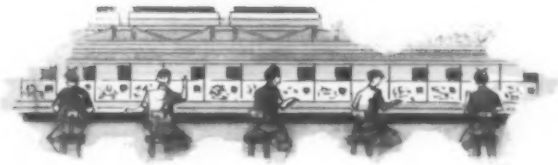
[a]CAR 18.30 *"Standard of performance: general.* All maintenance, repairs, and alterations shall be accomplished in accordance with methods, techniques, and practices approved by or acceptable to the Administrator."



Research

Development

Design



Production

AN INTEGRATED ELECTRONICS OPERATION

Navigational Gear
Guided Missiles
Radar
Noise Rejection
Counter Measures
Computers
Communications
Terminal Equipment
Transistors

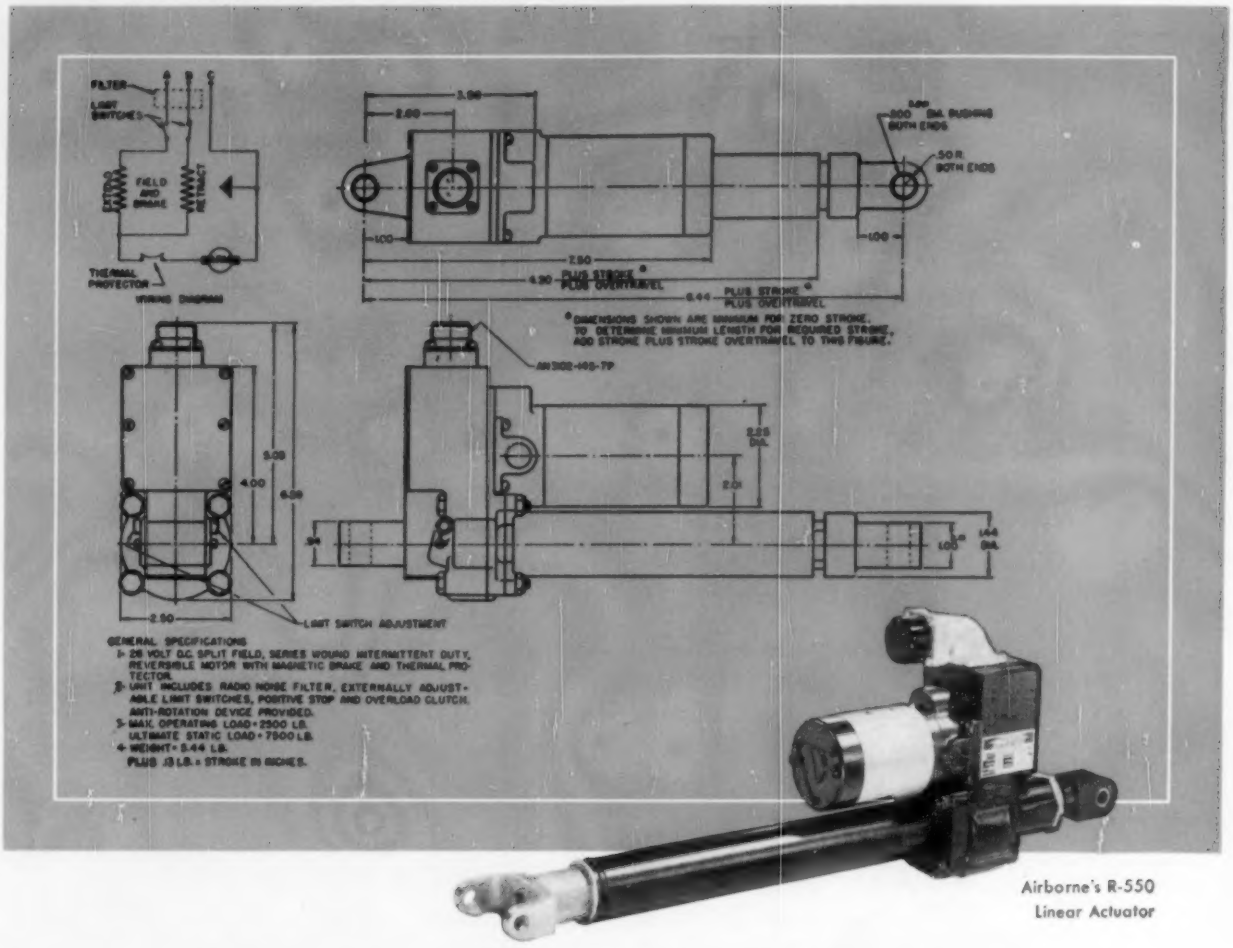
Hoffman
LABORATORIES, INC.
A SUBSIDIARY OF HOFFMAN RADIO CORP.

Hoffman's reputation for getting things done is due, in part, to the unification of Research-Development-Design-Production into one closely integrated electronics operation. At Hoffman – instead of the usual four completely separate operations – one technical director is assigned to co-ordinate each new project from start to finish. Every new project is developed in close cooperation with the divisions ahead, including the practical problems of quantity production. This integration practically eliminates the all-too-common duplications and overlapping of functions, the errors and re-work caused by poor liaison, and materially cuts down the usual time lag between the testing of the prototype and actual production. Hoffman has become a leader in electronics by doing progressively complex jobs – to specifications – to cost estimates – and on schedule.

Write for your copy of a
REPORT FROM HOFFMAN LABORATORIES

HOFFMAN LABORATORIES, INC.
A Subsidiary of Hoffman Radio Corp.
3761 South Hill Street, Los Angeles 7, California

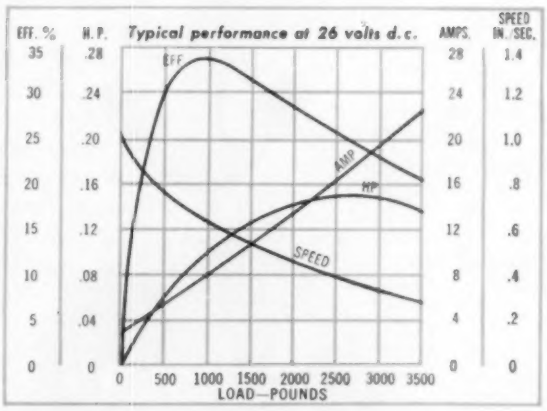
Challenging opportunities for outstanding electronics and mechanical engineers. Write Director of Engineering.


FILTER
LIMIT SWITCHES
FIELD AND BRAKE
EXTEND
RETRACT
THERMAL PROTECTOR
WIRING DIAGRAM
3.00
2.00
.500 DIA. BUSHING BOTH ENDS
.501 R. BOTH ENDS
1.00
1.00
7.50
4.30 PLUS STROKE PLUS OVERTRAVEL
6.44 PLUS STROKE PLUS OVERTRAVEL
* DIMENSIONS SHOWN ARE MINIMUM FOR ZERO STROKE. TO DETERMINE MINIMUM LENGTH FOR REQUIRED STROKE, ADD STROKE PLUS STROKE OVERTRAVEL TO THIS FIGURE.
AN3102-40S-7P
5.00
4.00
6.06
2.50
LIMIT SWITCH ADJUSTMENT
2.25 DIA.
2.01
.94
1.00
1.44 DIA.
GENERAL SPECIFICATIONS
1- 28 VOLT D.C. SPLIT FIELD, SERIES WOUND INTERMITTENT DUTY, REVERSIBLE MOTOR WITH MAGNETIC BRAKE AND THERMAL PROTECTOR.
2- UNIT INCLUDES RADIO NOISE FILTER, EXTERNALLY ADJUSTABLE LIMIT SWITCHES, POSITIVE STOP AND OVERLOAD CLUTCH. ANTI-ROTATION DEVICE PROVIDED.
3- MAX. OPERATING LOAD - 2500 LB. ULTIMATE STATIC LOAD - 7500 LB.
4- WEIGHT - 5.44 LB. PLUS .13 LB. x STROKE IN INCHES.

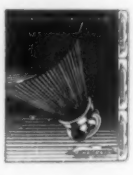
Airborne's R-550 Linear Actuator

HOW THE BEST ACTUATORS ARE BRED

We feel that no product is so good that it can't be improved. As Exhibit "A," we submit the R-550 Linear Actuator. It is a refinement—by no means a final version—of a happy marriage between an electric motor and a ball bearing jack screw. As Exhibits "B," "C," and so on, we submit the products listed at the bottom of this advertisement. Each step in the evolution of these designs was sparked by the special needs of an Airborne customer. The next version of any of these products may be your own. Bring your design problem to Airborne.



ANGLGEAR • LINEATOR® • TRIM TROL® • ROTORETTE® • ROTOLOK • ROTORAC®



AIRBORNE

ACCESSORIES CORPORATION

HILLSIDE 5, NEW JERSEY

COMPLETE INFORMATION on the Airborne line of electro-mechanical actuators is contained in our new aviation catalog. Send for your copy today.

Mexico Shifts Policy, Plans N.Y. Route

- **Government has given nod to CMA, country's largest airline, which is buying DC-7s for nonstop service.**
- **However, agreement with U. S. must come first; meanwhile, Air France skims cream off traffic.**

(McGraw-Hill World News)

Mexico City—The Mexican government has decided to encourage one of this nation's airlines to undertake nonstop service to New York, reliable sources here report.

This represents a complete shift in policy, both on the part of the government and of most of the carriers, who have felt it too expensive an operation to attempt to compete on this route with foreign carriers.

▶ **Orders DC-7s**—According to information reaching AVIATION WEEK here Compania Mexicana de Aviacion, the country's largest carrier—450,000 passengers a year and 13 million miles flying annually—not only is willing to fly the nonstop Mexico City-New York route but already has ordered three DC-7s, evidently for this purpose.

The Mexican government long has been unhappy to see scores of smaller countries with airlines flying into New York, while no Mexican line schedules flights there. It thus is willing to encourage the CMA project, if agreement on the route could be reached with the U. S. on an exchange basis.

That in turn depends upon the present Civil Aeronautics Board consolidated hearings with American, Eastern and Pan American over this route. All three would very much like to fly Mexico-New York nonstop.

▶ **One U. S. Carrier**—However, the CAB hearings in Washington are far from concluded. The examiner gave the airlines until Dec. 31 to file briefs following initial hearings, and his recommendation to the full Board probably will be made some time this month.

It is hardly considered likely that CAB will authorize more than one U. S. carrier on the route as the amount of traffic (running probably in the neighborhood of 50,000 passengers per year) would hardly warrant it considering the load must be split to some extent with the Mexican line.

From the Mexico end, most logical of the three would be American which already flies the route (though not nonstop) and owns extensive hangar facilities in Mexico, including the Monterrey Airport. American also has invested substantial sums in building traffic through advertising in the U. S.

▶ **The Other Side**—However, there is great pressure from the other U. S. carriers, each of which can offer a strong case. PanAm, of course, is a pioneer in Latin American service and presently flies from here to Houston where its New York passengers are transferred to Eastern.

Eastern has been after the Mexican route ever since the war. One of the principal Mexico City office structures is called the Eastern Airlines Building, although the line maintains only a ticket office and does not fly into Mexico.

One fact on this end that might influence the U. S. case is that the most likely Mexican line to get the local nonstop rights (CMA) is a Pan American affiliate and reportedly 40% owned by PanAm. It would seem unlikely to have two PanAm lines competing against each other.

▶ **Air France's Problems**—The only other Mexican airline reported interested in the New York route is Aerovias Guest, a Mexican-founded line backed by Winston Guest and currently flying between Mexico City and Miami. However, this line is operating only DC-4s at the moment and hardly is equipped to take on the New York flight.

Another interesting aspect of the Mexico City-New York struggle is that Air France, the carrier now serving the New York to Mexico City route nonstop, has a concession from Mexico which reportedly states that its Fifth Freedom rights cease upon the granting of the route to a Mexican airline. Naming of CMA apparently would automatically eliminate Air France-New York traffic.

Local agent for Air France is Aerovias Guest, which is doing a booming business for the French and thus is in Air France's corner on the matter.

▶ **Unhappy Allies**—Air France has cut heavily into American on the route. Air France flight is scheduled for only 7 hr., while American takes 12 hr. for the same trip, as it must land at San Antonio, Dallas and often at Washington.

It is estimated that 35% of AA's passengers are usually New York bound and that an even higher percentage of their revenue comes from through passengers.

U. S. carriers naturally are very unhappy to see a European carrier hauling the bulk of the New York-Mexico City traffic while the two nations concerned get only the minor part.

▶ **A Solution?**—One solution to this rather tight and involved problem, with no action in sight from CAB before spring, as the full Board still must hear oral arguments even after the examiner submits his report and the recommendation must go to the President, is this:

It is felt by airline experts here that a conditional agreement could be reached in a relatively short time with the Mexican government by having the State Department request the local U. S. embassy in Mexico City to approach Mexico's Communications Department.

The embassy could sound out the possibility of a conditional agreement on the single New York-Mexico City route and, if the Mexican department is as interested as reported, could reach a conditional agreement for carriers of the two countries to fly the route nonstop starting as soon as each country selected a carrier.

This would be a tacit admission that no bilateral agreement could be reached between Mexico and the U. S., but such apparently is the case as eight years of discussion have not resulted in one. It apparently is better at least to sign a New York-Mexico City nonstop route agreement.

Naming of the U. S. carrier for the nonstop route necessarily would depend upon the final Presidential decision, but the Mexican choice could be permitted to start nonstop flights at once.

Nonsked Temporarily Halts Nonstop Service

North American Airlines is temporarily discontinuing its DC-6B nonstop eastbound transcontinental flights (AVIATION WEEK Dec. 27, p. 78).

Evaluation flights indicate that these flights cannot be conducted under the existing 8-hr. crew limitation, Harold Cope, director of operations, North American Airlines, says.

"The flights will be resumed shortly, either with multiple crews, or in accordance with the requirements of special regulation 405, presently under consideration by the Civil Aeronautics Board," Cope says.

Civil Reserve Air Fleet Quotas

Number of planes allocated to Civil Reserve Air Fleet, and subject to military service in an emergency, is increased from 308 to 317 under a revised plan announced by Defense Air Transportation Administration.

Because of the large increase in capacity and speed of transports, DATA reports, the percentage of civil airlift required in the program has dropped from approximately 40% in 1951 to 38% at present. Percentage of four-engine airlift required has dropped from approximately 60% to 39%.

The 317-plane reserve—224 for Atlantic and 93 for Pacific operations—includes: 127 DC-4s; 105 DC-6s; 66 Constellation types, and 19 B-377 Stratocruisers. In addition, a contingent reserve, to provide for accident or other loss of planes in the reserve, is established. All aircraft will be controlled by the Military Air Transport Service.

This is the allocation of the 317 planes:

	DC-6A	DC-4	DC-6B	DC-6	B-377	Constellation	Total	Percent of lift
Certificated air carriers								
Alaska	..	1	..	..	..	..	1	29
American	3	9	25	10	..	..	47	34
Braniff	..	..	..	5	..	..	5	17
Capital	..	4	..	..	..	7	11	31
Colonial	..	2	..	..	..	..	2	29
Delta	..	..	..	7	..	..	7	18
Eastern	..	11	..	..	..	19	30	29
Flying Tiger	3	5	..	..	..	..	8	29
National	..	..	7	..	..	..	7	31
Northwest	5	5	..	..	3	..	13	34
Pacific Northern	..	2	..	..	..	..	2	33
Panagra	..	3	1	..	..	..	4	24
Pan American	..	26	..	..	16	..	42	33
Resort	..	7	..	..	..	..	7	35
Slick	2	..	..	..	..	..	2	27
Trans World	..	6	..	..	..	40	46	33
United	..	20	21	10	..	..	51	34
Western	..	..	5	..	..	..	5	29
Total	13	101	59	32	19	66	290	
Non-certificated carriers								
Cal-Eastern	..	4	..	..	..	..	4	
North American	..	2	..	1	..	..	3	
Seaboard & Western	..	5	..	..	..	..	5	
Transocean	..	7	..	..	..	..	7	
U. S. Overseas	..	8	..	..	..	..	8	
Total	..	26	..	1	..	..	27	
Grand Total	13	127	59	33	19	66	317	

TWA Completes Plan For Long-Term Credit

With its re-equipment program in high gear and prospects of Lockheed turboprop Super Constellations on the horizon, Trans World Airlines has completed a long-term refinancing program with Equitable Life Assurance Society.

In addition, the company has arranged standby credit with a group of major U. S. banks headed by the Irving Trust Company of New York.

▶ **Debt Boosted**—This increases TWA's debt considerably from $20.7 million at year-end. The carrier reduced its debt to that figure from a total of $41.8 million at the end of 1953.

In refinancing a $16-million debenture debt due Equitable in 1956, the total commitment to that company was increased to $40 million, secured by a 15-year general mortgage due in 1969. Of this, $15 million is initially outstanding.

The remaining $25 million will be used during the delivery period of TWA's 20 1049G Super Connies, February through June.

▶ **Revolving Credit**—As a result of this increased financing by Equitable, the airline has canceled out a bank credit of five-year maturity for $25 million, initially contemplated for financing the 20 Connies.

In connection with the standby credit agreement with Irving Trust and participating banks, TWA paid off $10.1 million of bank credits due serially to May of next year. A revolving credit has been substituted in the amount of $10 million, running to June 1957. Of this, $2 million was borrowed last month.

Other participating banks for the standby credit include: Bank of America, National Trust Savings Assn., Mellon National Bank & Trust Co., Bankers Trust of Boston, Security First National Bank of Los Angeles and California Bank.

National Airport Has Biggest Traffic Year

Washington National Airport had its biggest year in 1954, with total number of passengers handled increasing almost 15% over 1953 to hit the 3.1-million mark.

Despite the larger equipment introduced by most airlines, aircraft operations at the airport also were up over the previous year, showing an increase of 3.3%. An estimated total of 201,990 takeoffs and landings were made.

▶ **Increase Loading Capacity**—The terminal was continually faced with the problem during the year of having more aircraft on hand during peak hour periods than there were positions for loading and unloading. In an effort to ease this condition, construction has been started on a finger which will extend out from one present gate position to provide five additional loading stations.

From an economic standpoint, the airport finished in the black for fiscal year 1954, taking in $1.9 million as compared with a congressional appropriation of $1.3 million for its operation during the year. The airport does not retain its receipts. All income is turned over to the general fund of the U. S. Treasury and operating expenses for the following year are supplied in the form of congressional appropriations.

Seaboard Forecasts Atlantic Gains in '55

Despite persistent reports that Seaboard & Western Airlines' chances for a trans-Atlantic all-cargo certificate are slimmer than ever, the carrier looks forward to a big year in 1955.

Arthur V. Norden, executive vice president of the all-freight airline, reports that commercial cargo carried across the Atlantic by Seaboard during 1954 shows an increase in ton-miles of more than 100% over 1953. "Our economic forecasts for this year indicate that this curve will move up in impressive fashion," he says.

▶ **USAF Program**—Citing Air Force announcement of a new air logistics program, Norden said this alone should account for a big jump in business. "Initiation of this program by the Air Force in conection with the transportation of aircraft engines for overhaul will

have been increased by three factors:

ft. away as required previously. Visi-

reduce the engine overhaul cycle from 270 days now required by surface transportation to 100 days by air transportation, resulting in an estimated reduction of 25% in overall engine requirements," Norden points out.

"Thus, the government is placing into action the basic principles of present-day merchandising, namely—quick delivery, small inventories and fast turnover—in this new approach to military logistics. It is a known fact that the savings in shortening the pipeline from factory to combat forces not only lessen the all-important time factor but the burden on the taxpayer as well."

Western Omelet

- **CAB counsel proposes to expand service in West.**
- **Plan shifts trunk stops, bars nonsked coach bid.**

Airline service in the West will be expanded considerably if a pattern outlined by a Civil Aeronautics Board counsel is adopted by the Board. The proposed service is outlined in a brief filed by counsel for the Bureau of Air Operations with Examiner F. D. Moran in the Denver service case.

Under terms of the plan, Trans World Airlines and Western Air Lines would move into Denver, which has been United Air Lines' private territory as far as transcontinental service is concerned. United would move into Kansas City, now served by TWA.

American would be allowed to expand its nonstop east-west service.

Recommendations are:

- TWA would serve Denver on its transcontinental route, except that flights serving Denver couldn't serve Kansas City or St. Louis and flights to or from the West would have to originate or terminate in San Francisco, serving Los Angeles intermediately.
- United would serve Kansas City, except on flights serving Denver or Chicago.
- American's Routes 7 and 25 would be extended from Chicago to Los Angeles and San Francisco. This would allow American to offer nonstop and one-stop service from such cities east of Chicago as Detroit, Indianapolis and Buffalo to the West Coast.
- Western would get a new route segment between Oakland/San Francisco and Denver, via Reno and Salt Lake City. The authorization for Reno would be for a term of three years, and certain restrictions would be placed on service to points north and east of Salt Lake City other than Denver.

▶ **Passenger Benefits**—Bureau counsel said: "Competitive service affords the passenger the opportunity to receive various benefits in service. It can be introduced with the minimum adverse effects on comparatively dense traffic routes.

"The Bureau believes that the traffic on the major segments of the points in issue is sufficiently dense to warrant extending the area of competition. The proposals . . . are designed to extend competition believed to be in the public interest without economic disruption of the air transportation system and at the same time to furnish a substantial measure of new and improved service."

Applications for route expansions to the East and West by Continental Air Lines would not be granted by bureau counsel, but Continental's present service from Denver to Kansas City, and Denver-St. Louis through a Braniff Airways interchange, would be protected by restrictions against duplication of those services by United and TWA.

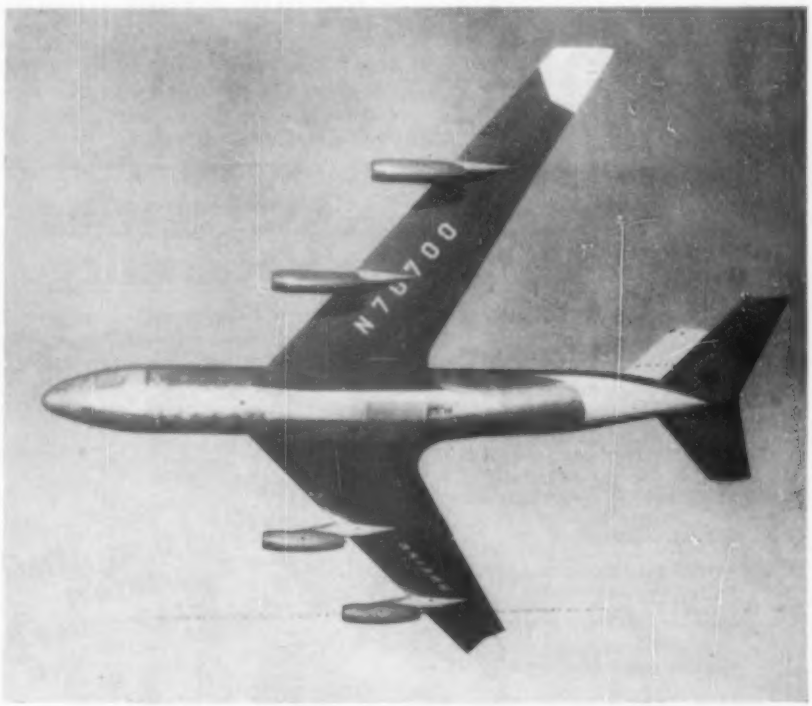
▶ **Nonsked Plan Refused**—The North American Airlines group wants to offer coach service Chicago-Kansas City-Denver-Los Angeles-San Francisco on the grounds that there is enough traffic so other carriers wouldn't be hurt and that the nonsked would be more efficient at developing coach traffic.

Counsel advises turning the North American application down, finding that service would be adequate under the proposed plan. Further, the brief observes that the nonsked's fitness has been questioned in the unresolved North American compliance proceeding.

In analyzing the factors involved in the case, it is found that it is one largely concerned with new competitive service in an area which has shown substantial growth in recent years. Three major points involved—Denver, Kansas City and Salt Lake City—have little or no competitive transcontinental service.

▶ **Requirements Increased**—No proof of inadequate service was found in the case of the carriers involved in the proceeding in relation to their service obligations.

It is pointed out that density requirements for economical route operation



Boeing 707 Climbs to New Heights

Boeing 707 jet tanker-transport prototype has cruised "substantially higher and at greater speeds" than the 42,000 ft. and 550 mph. previously reported, Boeing Airplane Co., Seattle, Wash., says—without giving exact figures. The company reports the 707 now has flown to higher altitudes than any other transport in history. It has successfully completed the second part of its test program and logged 92 hr. 30 min. flight time, with its cabin pressurized for all but two hours. Its P&W JT-3 twin-spool jets have been disassembled, for component inspection, with the engines remaining on their underwing pods. No parts replacement was necessary, Boeing states. While the 10,000-ft. runway was closed at Boeing Field for repairs recently, the 707 used a parallel 5,800-ft. taxiway and took off in less than half the available space.

TRANSISTOR &
DIGITAL COMPUTER
TECHNIQUES

applied to the design, development and application of

AUTOMATIC RADAR DATA PROCESSING, TRANSMISSION AND CORRELATION IN LARGE GROUND NETWORKS

ENGINEERS
&
PHYSICISTS

Digital computers similar to the successful Hughes airborne fire control computers are being applied by the Ground Systems Department to the information processing and computing functions of large ground radar weapons control systems.

The application of digital and transistor techniques to the problems of large ground radar networks has created new positions at all levels in the Ground Systems Department. Engineers and physicists with experience in the fields listed, or with exceptional ability, are invited to consider joining us.

fields include

TRANSISTOR CIRCUITS
DIGITAL COMPUTING NETS
MAGNETIC DRUM AND CORE MEMORY
LOGICAL DESIGN
PROGRAMMING
VERY HIGH POWER MODULATORS AND TRANSMITTERS
INPUT AND OUTPUT DEVICES
SPECIAL DISPLAYS
MICROWAVE CIRCUITS

Scientific and Engineering Staff

HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Culver City, Los Angeles County, California

Relocation of applicant must not cause disruption of an urgent military project.

have been increased by three factors: greater capacity of new airplane types, development of new aircraft with transcontinental nonstop capabilities and the burgeoning growth of aircoach services.

Transcontinental nonstop flights are found to have a marked effect on major intermediate cities because they can siphon off through traffic and cause a reduction of service to intermediate points.

▶**One-Carrier Argument**—Use of newer, larger aircraft and the introduction of high-density coaches also have traffic density requirements, since it takes more passengers to make them pay. The expansion of one-carrier service from the involved areas is pointed to as an improvement in service and a potential generator of new traffic. One-carrier service is more attractive to the passenger because his baggage and ticket arrangements are handled by a single company, and connections are usually easier to make.

New Canadian Rule: One Mile From Clouds

Canada's Dept. of Transport has ruled that planes flying under air traffic control must remain one mile away from cloud formations, instead of 2,000 ft. away as required previously. Visibility requirement west of the Rocky Mountains is increased from one mile to two miles.

The new rules, under consideration for some time, were tried out experimentally late in October for civil and military aircraft. The new regulations also require that planes flying under visual flight rules above 3,500 ft. proceed along normal airlanes and regulated altitudes. Planes crossing airlanes must do so midway between lanes and at an angle of at least 45 deg.

Engineering Versatility

If you enjoy diversified assignments, check your opportunity with Fairchild. We're looking for engineers experienced in

SHEET METAL STRESS ANALYSIS
SHEET METAL LAYOUT AND DESIGN

Write our EMPLOYMENT MANAGER

ENGINE AND AIRPLANE CORPORATION
FAIRCHILD
Aircraft Division
805 PENNSYLVANIA AVENUE
HAGERSTOWN, MARYLAND

Patterson Supports Railroad Subsidies

Los Angeles—United Air Lines president W. A. Patterson recommends that railroads be subsidized if necessary to see them through their economic difficulties.

"If railroads need subsidy to see them through a period of making adjustment to new markets, they should have subsidy and we will support it."

▶**Turns the Tables**—Patterson thus turns the tables on the railroads which have been complaining about airline subsidies. In fact, he says the airlines are in good economic health and require little subsidy.

"I don't intend to get into any controversy, but the railroads started 12 or 13 years ago complaining about the airlines and their subsidies," Patterson says. "It's an old record and it's getting a little scratchy."

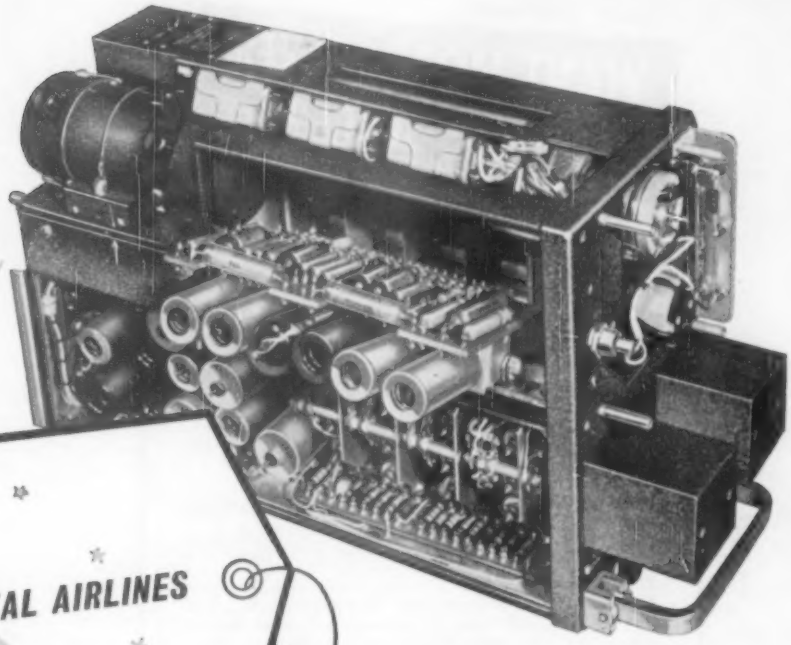
He points out that only 8% of today's airline passengers fly on subsidized airlines.

"It can be said that there does exist subsidy in a relatively new and very small portion of the air transport industry, namely, the local service airlines, which have been established by the Civil Aeronautics Board during recent years to serve communities so small that the resulting traffic does not permit economically self-sufficient operation," the UAL president says. "However, 98% of all airmail is carried without subsidy."

▶**Airmail Revenue**—He told a Town Hall meeting here last week that UAL and other major airlines receive 45 cents per ton-mile for carrying airmail whereas the revenue to the Post Office from postage on the mail amounts to $1.30 per ton-mile.

"It is true that we have taken away a substantial part of the railroad business," Patterson says. But he suggests that railroads strengthen and retain their dominant position in the transportation of freight, which he said always has been their principal source of revenue. "There is nothing on the scene today or visible in the engineering future of air transport to indicate the airlines will ever become a serious competitor of the rails in the field of

MARCONI RADIO COMPASS Type AD 7092 C*



The type AD 7092 C receiver showing accessibility of components.

SUPPRESSED LOOP

REMOTE CONTROLLER

Specified by Trans-Canada Air Lines and now chosen by Capital Airlines for their Vickers Viscounts.

Marconi Radio Compasses are in service with 40 of the World's leading Airlines.

Special Features include

- Light weight and small size—the receiver is only 15 lb and 8″ x 5″ x 12½″.
- Suppressed loop mounted flush with the aircraft skin.
- Small, low drag sense antenna providing improved 'turn round' performance.
- Entirely electrical remote control system giving complete freedom in positioning units.
- ARINC tubes throughout.
- Automatically tuned dual sense amplifier giving increased protection from interfering signals.
- Variable selectivity available.

** C.A.A. type approved*

MARCONI

Designers of the world's finest Radio Compass

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD, ENGLAND
U.S. Representatives: J. S. V. Walton, 23/25 Beaver Street, New York City 4.
J. C. K. Shipp, Suite 223, Dupont Circle Bldg., 1346 Connecticut Ave. N.W., Washington 6.

LA 7

know," the brief continues, "when and

WANT MORE POWER IN LESS SPACE?

INQUIRE ABOUT GLOBE MINIATURE
HI-TORQUE ROTARY ACTUATORS

With dimensions of only 2" x 5 1/16" max., units have load capacities up to 2000 in. oz. torque. Voltages range from 6 to 100 V. Units are waterproof, meet military specs., are radio noise filtered, can stop and reverse at any position, are normally wired for dynamic braking, equipped with adjustable limit switch and follow-up potentiometer. Write today for complete information.

Globe industries, inc.
MOTORS • GEAR REDUCERS • GENERATORS • GOVERNORS • SERVOS
BLOWERS • FANS • ACTUATORS • SWITCHES • GYROS • VIBRATORS
1802 STANLEY AVE., DAYTON 4, OHIO

AERONAUTICAL ENGINEERS
AERODYNAMICISTS

Openings are available for junior and senior research engineers to work in two supersonic wind tunnels and one hypersonic wind tunnel (under construction) as test project engineers. Duties include responsibility for pretest planning, calibration, test supervision, data reduction, and report preparation.

This is an unusual opportunity to participate in diversified types of tests and to gain experience in testing techniques, use of electronic test equipment, IBM and electronic data handling and computing, automatic machine plotting, etc.

Airmail your resume today to:

Caltech
JET PROPULSION LABORATORY
4800 Oak Grove Drive
Pasadena 3, California

AERODYNAMIC ENGINEERS
FOR
LONG RANGE GUIDED MISSILE PROGRAM

Stability and control analyses on automatically controlled missiles. Complete dynamic studies of the controlled missile system. Flight trajectory and performance calculations. Airloads and flight criteria. Aerodynamic heating problems of high speed flight.

North American facilities include supersonic wind tunnels. Construction will soon begin on a new 7 x 7 foot tri-sonic wind tunnel. Company engineers also conduct research and development at government testing facilities throughout the country.

For additional information, please forward resume to:

MISSILE & CONTROL EQUIPMENT Dept A
Engineering Personnel
NORTH AMERICAN AVIATION, INC.
12214 Lakewood Blvd.
Downey, California

airlines will ever become a serious competitor of the rails in the field of freight," he said.

▶ **Freight Advantage**—Patterson believes there is no question that railroads have a problem, but he says their advantages in the freight field can restore their economic health.

"You can pull a lot cheaper than you can lift. We lift for cents per ton-mile; they pull for mills per ton-mile."

Patterson's speech in Town Hall followed lines close to those of American Airlines president C. R. Smith's "How to Run a Railroad" speech (AVIATION WEEK Dec. 20, 1954, p. 15), which was also delivered here in Los Angeles.

Dallas Wins Support In Airport Squabble

Another chapter in the Ft. Worth-Dallas airport squabble unfolded last week.

Failure of Civil Aeronautics Board to give notice to and permit Dallas to be heard prior to rendering a decision in the Central Airlines renewal proceeding was a violation of the due process clause of the federal Constitution, says the National Institute of Municipal Law Officers in a brief filed with the U. S. Supreme Court.

The organization, which is composed of more than 900 municipal corporations, filed the brief supporting the Dallas petition as a friend of the court. NIMLO is not a party to the case, but is interested in the outcome. Such briefs are permitted in order to assist the court in making its decision.

▶ **Use Ft. Worth**—In rendering its decision in the case, CAB had stipulated that Central's certificate was granted for service between Oklahoma City, various intermediate points and the terminal point Dallas-Ft. Worth—to be served through Ft. Worth International Airport.

In this case, says NIMLO, CAB departs from this established policy in that "it prohibits the use of one of the most active civil airports in the country for reasons of traffic convenience and operating efficiency, both matters of judgment peculiarly within the competence of officials of the airline and municipality concerned."

▶ **New Policy?**—In its brief to the court, NIMLO says: "If this represents a new policy and attitude of the Board, and if it is put into practice without notice and hearing, as claimed by the city of Dallas, it has profound significance to the growing number of air centers which have more than one airport within a distance which the Board may decide is 'adequate' or 'convenient.'

"These communities are entitled to

know," the brief continues, "when and how the policies of the federal government affect their interests. They are entitled to a fair opportunity to contest those policies, if an actual or potential conflict with local interests exists.

". . . Each of the important air centers is intermittently involved in the continuing parade of route certification proceedings before CAB. Municipalities are not organized and financed to maintain continually their guard against federal resolution of their problems in constantly recurring legal proceedings.

"Futhermore, it is not in the public interest that they be subjected to such expense and uncertainty, merely because CAB has deliberately or inadvertently failed to give notice to the public of fundamental changes in policy and of the scope of legal proceedings as they affect local interests."

▶ **Four Proceedings**—NIMLO says the extent of this burden is fairly indicated by the current involvement of Dallas in four route certificate proceedings in which the use of Love Field has been or could be involved.

"The prospect of litigation before the Board, or before the courts, if necessary, as a continuing process of maintaining a local voice in local affairs is profoundly disquieting to the large and growing number of communities dependent on civil air transportation," the brief stated.

In conclusion, NIMLO asked the court to order CAB to grant the city an opportunity to be heard in this case. "Only in this way can the important issue involved be decided fairly, upon a record, and in keeping with the due process of law required by the federal Constitution."

SHORTLINES

▶ **British Overseas Airways Corp.** claims an unofficial New York-Nassau speed record of 3 hr. 19 min. made on a scheduled flight by a BOAC Stratocruiser.

▶ **KLM Royal Dutch Airlines** has added Sao Paulo, Brazil, to its South American service. Sao Paulo will be served weekly on KLM's Amsterdam-Rio de Janeiro-Buenos Aires route.

▶ **Mohawk Airlines** plans to build a new passenger terminal at Cornell University Airport in Ithaca, N. Y. The new building, which is scheduled for Apr. 1 completion, will provide expanded passenger-handling facilities and make added office space available in the present office-terminal building.

10,000 years of weapons engineering experience

If you're looking for an opportunity to work with the finest mindpower and facilities in the whole new world of aircraft development... if you want to harness the power of great knowledge to your own technical training... then you should know this:

Martin's engineering staff represents an aggregate of 10,000 man-years of engineering experience, covering every branch of the aeronautical sciences.

And there is—and always will be—a need for outstanding "new blood" in this organization.

If it's only a job you want, the woods are full of them. But if you are one of the few who are destined to go far in this industry, you'd be wise to take an engineer's-eye view of the mindpower and the facilities you'll be working with.

Write to J. M. Hollyday, Box A-1, The Glenn L. Martin Company

MARTIN
BALTIMORE · MARYLAND

TO THE FINE ENGINEERING MIND
SEEKING THE CHALLENGING PROJECTS IN

DYNAMICS

Convair, in beautiful San Diego, California, now offers exceptional career opportunities to **DYNAMICS ENGINEERS** with experience in general flight and control dynamics for both airplane and missile design – analysis and synthesis of servomechanisms, autopilot design, controls and computers – aeroelasticity, fluid dynamics, vibration and flutter – aerodynamic, dynamic, and transient load analysis – solution of dynamic problems by analytical methods and by analog machine computations. Special opportunities for men holding advanced engineering, physics, or mathematics degrees.

At **CONVAIR** you will find an imaginative, explorative, energetic engineering department . . . truly the "engineer's" engineering department to challenge your mind, your skills, your abilities in solving the complex problems of vital, new, long-range programs. You will find salaries, facilities, engineering policies, educational opportunities and personal advantages excellent.

Lovely, sunny, **SMOG-FREE SAN DIEGO**, ever-growing area of three-fourths million people, offers you and your family a way of life judged by most as the Nation's finest for climate, natural beauty and easy (indoor-outdoor) living. Housing is plentiful and reasonable.

Generous travel allowances to engineers who are accepted. Write at once enclosing full resume to:

H. T. Brooks, Engineering Personnel, Dept. 101

CONVAIR

A Division of General Dynamics Corporation

3302 PACIFIC HIGHWAY SAN DIEGO, CALIFORNIA

An Opportunity

WIND TUNNEL RESEARCH

An excellent opportunity exists for recent graduates with an Aeronautical Engineering option or degree to enter the field of large scale, high speed wind tunnel operation. After a short period of informal training, the graduate would receive the assignment of assistant project leader. In this post he would assist in the planning of test programs and instrumentation requirements for model tests and air flow calibrations. Actual experience will also be gained in the supervision of data reduction, analysis, and report preparation.

Additional information concerning the position described above and others is available upon request.

CORNELL AERONAUTICAL LABORATORY, INC.

BUFFALO 21, NEW YORK

ENGINEERS

new aircraft projects

at **RYAN**

IMMEDIATE OPENINGS FOR

Aerodynamicists
Research Engineers
Engineering Designers
Systems Analysts
Electronic Engineers
Dynamics Engineers

Replies to Administrative Engineer will be held in strict confidence

RYAN
AERONAUTICAL COMPANY
SAN DIEGO 12, CALIF.

SKILLED
PILOTS
AVAILABLE
No Fee to Employers
PILOTS EMPLOYMENT AGENCY
Teterboro (N. J.) Airport
Hasbrouck Heights - 8-1091

GOOD ENGINEERS GO with GOODYEAR AIRCRAFT

Forceful, creative thinking by top-flight engineers is the key to Goodyear's progressive research and development programs.

Experienced engineers . . . men with ability and imagination . . . do top work for Goodyear. Positions are open to qualified physicists and electronic, electrical, and mechanical engineers for research, design, development, and product engineering in these fields:

Electro-mechanical	Pulse Techniques
Microwave	Weapons Systems
Servomechanisms	Antenna Design
Electronic Packaging	Miniaturization

Send a résumé of your qualifications or request application—

C. G. Jones, Salary Personnel Department

GOODYEAR AIRCRAFT CORPORATION

1210 Massillon Road Akron 15, Ohio

GOODYEAR AIRCRAFT

YOUR
CALLING CARD FOR
A BRILLIANT FUTURE...

Bendix Missile Section is a major contractor in the U. S. Navy's guided missile program--a part of the "new look" in our defense plan. Our expanding program has many opportunities for senior engineering personnel: Electronics Engineers, Dynamicists, Servo-Analysts, Stress Analysts, Project Coordinators, and Designers. Take time now to look into the opportunities which Bendix can offer you. Write Employment Dept. M, 401 Bendix Drive, South Bend, Indiana.

Helicopter Pioneer needs...

WEIGHTS ENGINEER

. . . with at least 5 years' experience in general aircraft weights control problems. Either a graduate engineer or a man with good practical knowledge may apply.

TEST ENGINEERS

. . . to do experimental test work on rotary wing aircraft. Aeronautical, mechanical or electrical engineers are needed for static, structural, fatigue, dynamic, vibration tests, and full-scale whirl testing. To qualify, a college degree is required as well as a sincere desire to investigate helicopter performance.

These are challenging positions that can lead to professional achievement and advancement in a rapidly growing field.

Apply in person or send complete resume to
R. L. AUTEN, *Personnel Department*

SIKORSKY AIRCRAFT
Bridgeport 1 Connecticut

ELECTRONIC ENGINEERS

SYSTEMS
RADAR
COMMUNICATIONS
NAVIGATION
CONTROL
TECHNICAL WRITERS
also
DESIGN DRAFTSMEN

Applicants must have EE degree and 4 years' experience in the field of airborne electronics.

WRITE

RAS INCORPORATED

READING AVIATION SERVICE, INC.
BOX 1201, READING, PENNSYLVANIA

ENGINEER
Laboratory Equipment

Must have practical experience in and be capable of doing electrical and mechanical design and specification writing for permanent and special equipment to test aircraft accessories to Air Force qualification requirements. Electronic and instrument experience desirable. Graduate E.E. or M.E. preferred.

WRITE TO EMPLOYMENT MGR.

LEAR, INC.
110 Ionia Ave., N. W.
Grand Rapids 2, Mich.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)
LOS ANGELES: 1111 Wilshire Blvd. (17)

POSITIONS VACANT

AIRCRAFT RADIO Mechanics 2nd class license. Experienced Collins and Bendix service and installation. Atlantic Aviation Corporation, Teterboro, New Jersey. Phone: Hasbrouck Heights 8-1740.

AMBITIOUS A & E Mechanic Ex-Pilot or Powerplant engineer capable of growing with company as a Sales and service representative. $6,000 yearly to start. Must have good background in engine overhaul and operations. Much travel. Base in Southern California. Send letter of qualifications to P-5032, Aviation Week.

WANTED: HELICOPTER mechanics and inspectors with Sikorsky S-55 or Bell experience, field or overhaul. CAA licenses preferred but not essential. Write giving resume of experience and qualifications. P-5035, Aviation Week.

POSITION WANTED

A&E MECHANIC, lic, 12 years ex. 4 years airlines overseas some helicopter exp. Single, desires foreign position. PW-5056, Aviation Week.

FOR SALE

Largest stock in the U. S., of new, used and overhauled engines, propellers, accessories and airframe parts. Free lists by makes. Vesto, Dept. F, Box 5306 T.A., Denver, Colo.

ENGINEERS

DID YOU KNOW?

THAT CESSNA AIRCRAFT COMPANY NOW HAS

1 JET TRAINERS & TURBO PROPS UNDER DEVELOPMENT

2 HELICOPTERS NOW BEING TESTED IN FLIGHT

3 A 4-ENGINE BUSINESS AIRLINER IN THE PROTOTYPE STAGE

AND MANY OTHER INTERESTING PROJECTS "IN THE WORKS"

THIS IS YOUR OPPORTUNITY TO GROW WITH A GROWING COMPANY

Cessna offers competitive salaries; job stability; flying club; and the convenience of living within 15 minutes of work in a friendly city. BUT, EVEN MORE IMPORTANT, Cessna offers fertile soil for new ideas, individual recognition and maximum opportunities in both civil and military aviation. You are not just a cog in a machine.

WRITE:
Cessna Aircraft Company
Dept. AWP-1, Wichita, Kansas
State experience and qualifications.

RCA OPENS NEW HORIZONS in AVIATION ELECTRONICS!

ADVANCE THE SCIENCE OF

FIRE CONTROL • PRECISION NAVIGATION • COMMUNICATIONS

You'll find challenge in: Systems, Analysis, Development or Design Engineering

And you can specialize in: Radar • Analog Computers • Digital Computers • Servo-Mechanisms • Shock & Vibration • Circuitry • Heat Transfer • Remote Controls • Sub-Miniaturization • Automatic Flight • Transistorization • Design for Automation

You should have: Four or more years' professional experience and your degree in electrical or mechanical engineering, or physics

You'll find unlimited opportunities for professional advancement in RCA's broadened aviation electronics program! Suburban or country living nearby. Relocation assistance available.

And at RCA, you'll move ahead through *learning* as well as *doing* . . . for RCA encourages you to take engineering *graduate* study with company-paid tuition. You'll also enjoy professional status . . . recognition for accomplishment . . . unexcelled facilities . . . *many* company-paid benefits.

Your RCA career can start now! Begin by sending a resume of your education and experience to:

Mr. John R. Weld, Employment Manager
Dept. B-2A, Radio Corporation of America
Camden 2, New Jersey

RCA® RADIO CORPORATION OF AMERICA

Your role in . . .

Now . . with the unique wind tunnels and altitude test cells of the U. S. Air Force's huge Arnold Engineering Development Center beginning operations . . . . there are extremely attractive opportunities for engineers and scientists who want a role in the vital developmental testing in the aircraft, missile and propulsion fields. As an employe of ARO, Inc., operating contractor for the Center, you will find a challenging job, excellent remuneration and allied benefits, and a career field with limitless opportunity for advancement and achievement.

Specific assignments now available for graduate engineers with one to ten years experience in the development and testing of aircraft propulsion systems and related mechanical equipment. Engineers employed will be assigned to development projects concerned with new ramjet and turbojet engines and test equipment.

If you are an interested aeronautical, mechanical or electrical engineer, send a resume of your education and experience to Lee C. Kelley, Jr., Box 162, Tullahoma, Tennessee.

ARO, INC.
TULLAHOMA, TENNESSEE
ARNOLD ENGINEERING DEVELOPMENT CENTER

Vice President Engineering

Experienced in stress analysis and sheet metal fabrication to head engineering and production for manufacturer of large sheet metal products. Texas location. Local interview can be arranged. Write particulars. Hills Engineering Co. P. O. Box 9, Des Plaines, Ill.

AIRPLANES WANTED

Need 50 Bonanzas, Navions, 180's, 190's, 170's, Aero Commanders, Twin Navions, Twin Beeches, etc.
Will Buy Dealers' Stocks New or Used
Vest Aircraft Co.'s Skyranch
BOX 5308, DENVER 17, COLORADO

PITTSBURGH RADIO DIVISION NOW OPEN

Complete Test Facilities For The Inspection and Servicing of—

COLLINS – BENDIX
LEAR – SPERRY – ARC

Under the direction of—

ART VANDENBURGH
(Formerly of Collins Radio)

TOM PRICE
(Formerly of Colonial Airlines)

Tel: Genesee 7301
Rochester Airport
Rochester, N. Y.

Page AIRWAYS inc.

Tel: Homestead 1-4044
Allegheny County Airport
Pittsburgh, Penna.

SPECIAL SERVICES

PARTS & SUPPLIES

R. K. Brown Co.
PARTS SPECIALIST
STROMBERG INJECTION CARBURETOR
CARBURETORS PARTS ASSEMBLIES
CARBURETORS SUPPLIED IN REPAIRABLE CONDITION OR OVERHAULED AND CERTIFIED BY CAA APPROVED REPAIR STATION.
Parts also available for Holley Carburetors
238-A PARK AVE. EAST RUTHERFORD, N. J.
WEbster 9-9250, 9-9251 Cable Address "Brownaero"

NAVCO INC.
Lambert Field
St. Louis, Mo.
TErryhill 5-1511
Has all Parts and Supplies for Executive DC-3 LODESTER BEECH
Airframe Engines Radios
A.R.C. Bendix Collins Lear Sperry Wilcox
P&W Continental Wright Goodrich Goodyear

INSTRUMENT SERVICE

kymotive INC.
O'HARE FIELD
CHICAGO INTERNATIONAL AIRPORT
Box 448 Park Ridge, Ill.
TUxedo 9-2100
A.R.C. — BENDIX — LEAR
C. A. A. Repair Station 3712
Airframe Class I and III
Radio Class I and II
No limitations

DIAL REFINISHING

We can refinish your dials or can supply many standard dials from our stock.
Screen Process or Hand Painted.
Fluorescent - Phosphorescent - Radium.
Special Dials made to order. Prompt Delivery.
Reasonable prices.
SOONER DIAL CO.
Box 234 - Clinton, Oklahoma - Phone 486

S. M. S. INSTRUMENT Sales & Serv. Inc.
NY International Airport
Jamaica 30, N. Y.
CLASS 1, 2, 3, 4 unlimited
OL6-5678 TWX NY4-396

AIRCRAFT DEALERS

EXECUTIVE AIRCRAFT
Complete Services and Sales
DC-3 LODFSTAR D185

Inc. of ST. LOUIS **REMMERT-WERNER** Inc. of TOLEDO

FEATURE PAGE

WANTED

To Lease DC-4

To be used as a freighter, with —13 engines and equipped for 73,000 pounds gross take-off. State full terms possibly could be a lease-purchase. Address replies to

W5064, Aviation Week
68 Post St., San Francisco 4, Calif.

SUPER-92

over **200** mph for your **DC-3**

CAA Approved R1830-SUPER-92 engines allow 700 HP normal cruise, better single engine—lower fuel and maintenance mileage costs with 20,000 extra miles between changes, with same overhaul intervals and costs as —92. Fully interchangeable with —92 —same weight, mounts, cowls, lines, etc. Proven by thousands of hours of practical executive operation.

ENGINE WORKS

LAMBERT FIELD INC. ST. LOUIS, MO.
PRATT & WHITNEY CONTINENTAL
WRIGHT LYCOMING
SALE OVERHAUL EXCHANGE

FOR SALE—BEECHCRAFT

Mod. D-18S, Ser. # A-50. Tot. airframe hrs.—3850:00. ENGINES: P&W, R-985-AN114B—time since major, right 640, left 131. PROPELLERS: Hamil. Stand. Hyd. time, right 640, left 131. EQUIPMENT: De-icing, anti-icing, windshield wiper installation, aux. gas tank, comp. overall paint job, pilot relief tube, control surface lock, super soundproofing, "No smoking—Fasten Seat Belt" sign, 2 spare engines. RADIO: ARC-15B Omni, ARC-I 50-ch. transceiver, RTA-1B Ship-To-Shore tel., ARC 24-ch. transmitter, ARC T-11 5-ch. transmitter, ARC R-15 VHF Receiver, Bendix ADF, Lear 2200 3-light Marker, Range Receiver, R-89M 6-ch. Glideslope, F-11 Isolation Amp., 2 speakers, PA system, Lear L-2 Autopilot with Approach Coupler and Alt. Control, Plastic edge-lighted overhead radio control panel completely rewired Jan. '54. INTERIOR: 3 chairs and couch. Upholstery—two tone green. Newly upholstered Jan. '54. Cabin table, thermos bottle installation and cup holder. EXTERIOR: Painted grey with orange and blue trim—white top. Price $70,000. Available immediately.

Reading Aviation Service, Inc.,
Box 1201, Reading, Penna.

HILLER HELICOPTER

Model UH 12A with Agricultural Spray equipment, full canopy, dual controls, 2-way radio.

In excellent condition

East Coast Aviation Corporation
Bedford Airport Lexington, Mass.

FIRE CONTROL ANALYSTS

Mathematicians • Electrical Engineers • Physicists

needed for immediate openings in all levels of employment. These are top ranking technical positions together with training positions leading to top responsibility in mathematical analysis for electronic fire control, computers, and servomechanisms.

- Household goods moved
- Liberal employee benefits
- Interview expense paid

Send written resume to

REMINGTON RAND, Inc.

ERA Division
1902 W. Minnehaha Ave. St. Paul 4, Minn.

AERONAUTICAL ENGINEERS

We are seeking to supplement our research staff with young engineers of high calibre who are experienced in the fields of

Aeroelasticity
Thermodynamics
Theoretical Aerodynamics
Structural Dynamics
Aircraft Performance

If you are interested in joining a progressive organization of consulting scientists, send resume of education and experience to:

ALLIED RESEARCH ASSOCIATES, INC.
43 Leon Street, Boston, 15, Mass.

CAA APPROVED REPAIR STATION—
AIRCRAFT, RADIO AND INSTRUMENTS

Dealers for Lear, Collins & Bendix Radio and Eclipse-Pioneer Instruments

SOUTHERN CALIFORNIA AIRCRAFT CORPORATION
Ontario International Airport
Ontario California

PBY-5A AND LUXURY TYPE "LANDSEAIRE"
CESSNA AIRCRAFT DEALER

- Specializing in PBY-5A — C-47 — DC-3 — B-25 — Lodestar — Beechcraft
- Fully equipped to do Maintenance and Overhaul on all types of Aircraft
- Ultra Modern Interiors and Conversions

ADVERTISERS IN THIS ISSUE

News Sidelights

Ryan Aeronautical Co.'s jet-powered vertical-takeoff fighter, under construction for the Air Force, now has reached "an advanced stage," the company reveals in its year-end report.

Los Angeles Airways reports load factors on its new Long Beach-Los Angeles passenger helicopter routes have been "modest," but that traffic is increasing. LAA is surprised to find more coast-wise than transcontinental passengers using the service. Other southern California routes are anticipated before April.

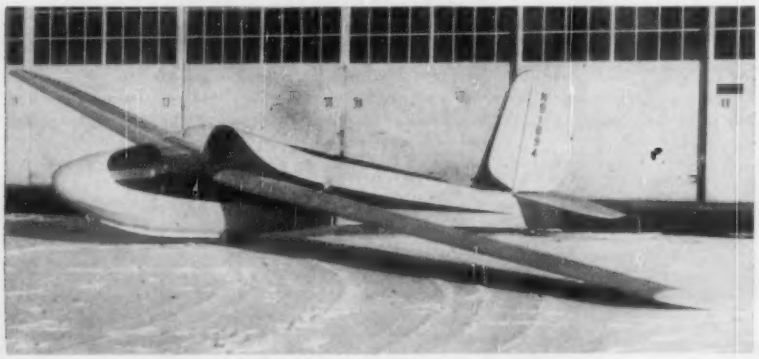
Landing fees at Teterboro (N. J.) Airport on aircraft weighing 2,500 lb. and over were inaugurated Jan. 1 by Port of New York Authority. The charge is $2.50 per takeoff for planes from 2,500 lb. to 7,500 lb.; for planes over the latter weight, the toll will be 20 cents per 1,000 lb. of maximum gross weight. Owners in the 2,500 to 7,500-lb. category may pay $10 monthly or $100 annually for unlimited use of the field if they prefer. PNYA notes that of 101,400 takeoffs made at the airport in 1953, 35,000 were in the less-than-2,500-lb. range.

First operational unit to get new North American F-86H Sabres is the 312th Fighter-Bomber Wing, Clovis AFB, N. M.

More than 11,000 engine hours were flown without major overhaul by the 93rd Bomb Wing's recently acquired Boeing B-47s during the first 62 days of jet operation by the unit. Cleanliness played an important role in attaining this time. Duct covers were placed on the engines; airport runways, landing areas and parking aprons were electromagnetically swept to prevent foreign matter from contaminating the General Electric J47 jets.

Airline stretcher case service has been inaugurated by Trans World Airlines—with kits located at New York, Chicago, Kansas City, Los Angeles and San Francisco—for use by patients, who must clear travel through the TWA's medical headquarters. Charge for the service is price of four full-fare, oneway tickets.

Bell 47G copter is being used as a flying ambulance by the Province of Newfoundland. On 24-hr. call, the craft picks up emergency cases upon dispatch by radio, and takes them to hospital at St. John's.



'BUILD-IT-YOURSELF' SAILPLANE is being offered by Schweizer Aircraft Corp., Elmira, N. Y., in kit form at prices ranging from $1,385 to $1,495. The firm says the kit can be assembled by one person in four-five months of spare time, more quickly if a group participates. Design approval of the single-place craft has been granted by Civil Aeronautics Administration. Designated the 1-26, it spans 40 ft., has an empty weight of 348 lb., a maximum gross weight of 575 lb. Glide ratio exceeds 23:1. Schweizer says the kit is applicable to construction in schools as an aid to developing airmindedness in youth. The company has had youth aviation training programs operating for years, regularly expands them to cover new projects.

AVIATION CALENDAR

Jan. 19-23—Miami International Aerorama, Miami (Fla.) International Airport.

Jan. 20-21—Institute of Radio Engineers and Radio-Electronics-Television Manufacturers Assn., Symposium on Printed Circuits, University of Pennsylvania, Philadelphia.

Jan. 20-22—Conference on High-Speed Aerodynamics, organized by the Department of Aeronautical Engineering of the Polytechnic Institute of Brooklyn, Engineering Societies Building, New York.

Jan. 24-27—American Meteorological Society, 135th national meeting, New York University College of Engineering, New York.

Jan. 24-27—Plant Maintenance & Engineering Show and three-day conference, International Amphitheatre, Chicago.

Jan. 24-28—Institute of the Aeronautical Sciences, 23rd annual meeting, Honors Night Dinner, Hotel Astor, New York.

Jan. 27-28—Southern California Meter Assn., fourth annual Instrument Short Course, Los Angeles Harbor Junior College, Wilmington, Calif.

Jan. 31-Feb. 4—American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York.

Jan. 31-Feb. 4—American Society for Testing Materials, annual Committee Week, Netherland Plaza Hotel, Cincinnati.

Feb. 8-10—National Association of State Aviation Officials, winter meeting of board of directors, Lafayette Hotel, Washington, D. C.

Feb. 8-10—Society of the Plastics Industry, 10th Reinforced Plastics Division Conference, Hotel Statler, Los Angeles.

Feb. 10-11—Society of American Military Engineers, military-industrial conference on manpower, Conrad-Hilton, Chicago.

Feb. 11—Air Transport Command, 10th reunion dinner of World War II officers, Waldorf-Astoria Hotel, New York.

Feb. 20-22—Fourth annual Texas Agricultural Aviation Conference, A&M College of Texas, College Station, Tex.

Feb. 26-27—Associated Glider Clubs of Southern California, ninth annual Pacific Coast Mid-Winter Soaring Championships, Torrey Pines Glider Port, San Diego.

Mar. 11—Institute of the Aeronautical Sciences, National Flight Propulsion Meeting (restricted), Hotel Carter, Cleveland.

Mar. 14-16—Society of Automotive Engineers, production meeting and forum, Netherland Plaza, Cincinnati.

Mar. 14-18—American Society of Tool Engineers, first Western Industrial Exposition, Shrine Auditorium and Convention Hall, Los Angeles.

Mar. 21-24—Institute of Radio Engineers, national conference, Waldorf-Astoria Hotel and Kingsbridge Armory, New York.

Mar. 28-Apr. 1—American Society for Metals, ninth Western Metal Exposition and Congress, to include the American Welding Society's technical session on aircraft and rocketry, Pan Pacific Auditorium and Ambassador Hotel, Los Angeles.

Apr. 5—International Air Transport Assn., technical conference, San Juan, P. R.

LETTERS

ADVERTISERS IN THIS ISSUE

AVIATION WEEK—JANUARY 10, 1955

ACCESSORY PRODUCTS COMPANY 53, 54, 55
Agency—Anderson-McConnell Adv. Agency

ADEL DIV., GENERAL METALS CORP. 27
Agency—The McCarty Company

AIRBORNE ACCESSORIES CORP. 80
Agency—Gray & Rogers Adv.

AIRCRAFT BOLT CORP. 67
Agency—Elmer W. Ayer Adv.

AIRESEARCH MFG. DIVISION OF THE GARRETT CORP. 5
Agency—J. Walter Thompson Co.

ALLISON DIV., GENERAL MOTORS CORP. ..... Fourth Cover
Agency—Kudner Agency, Inc.

AMERICAN ELECTRONICS MFG., INC. 8
Agency—Clyde D. Graham Adv.

B. H. AIRCRAFT CO., INC. 78
Agency—Harold Marshall Adv. Co., Inc.

BEECH AIRCRAFT CORP. 6, 86
Agency—Associated Advertising Agency, Inc.

BELL AIRCRAFT CORP. 47
Agency—Comstock & Co.

BENDIX RADIO DIV., BENDIX AVIATION CORP. .. 38
Agency—MacManus, John & Adams, Inc.

BOWERS BATTERY & SPARK PLUG CO. 105

BRIDGEPORT THERMOSTAT DIV., ROBERTSHAW-FULTON CONTROLS CO. 84
Agency—Arndt-Preston-Chapin-Lamb & Keen, Inc.

CALTECH, JET PROPULSION LABORATORY 96
Agency—The Perrett Co.

CANADAIR, LIMITED 51
Agency—Walsh Advertising Co., Ltd.

CLIFFORD MFG. CO., DIV. OF STANDARD-THOMSON CORP. 44, 45
Agency—Shattuck, Clifford McMillan, Inc.

COM-AIR PRODUCTS, INC. 19
Agency—McHugh-Cather Adv. Agency, Inc.

CONSOLIDATED DIESEL ELECTRIC CORP. 24
Agency—De Garmo, Incorporated

CONTINENTAL MOTORS CORP. 88
Agency—The Hopkins Agency

CUTLER-HAMMER, INC. 23
Agency—Kirkgasser-Drew Adv.

DARNELL CORP., LTD. 76
Agency—Henry L. Rhea Adv.

DOUGLAS AIRCRAFT CO., INC. 77
Agency—J. Walter Thompson Co.

EASTMAN KODAK CO. (X-RAY DIVISION) 41
Agency—J. Walter Thompson Co.

ECLIPSE-PIONEER DIV., (FOUNDRIES) BENDIX AVIATION CORP. 73
Agency—MacManus, John & Adams, Inc.

ELECTRICAL ENGINEERING & MFG. CORP. ... 32, 33
Agency—West-Marquis, Inc.

ELECTRO TEC CORPORATION 87
Agency—George Homer Martin Associates

ESSO STANDARD OIL CO. 26
Agency—McCann-Erickson, Inc.

FAIRCHILD ENGINE & AIRPLANE CORP. 36, 75, 94, 105
Agency—Gaynor & Company, Inc.

FLETCHER AVIATION CORPORATION 48, 64, 78
Agency—Hixson & Jorgensen, Inc.

FULTON SYLPHON DIV., ROBERTSHAW-FULTON CONTROLS CO. 84
Agency—Arndt-Preston-Chapin-Lamb & Keen, Inc.

FUSITE CORPORATION, THE 83
Agency—Perry-Brown, Inc.

GARRETT CORP., AIRESEARCH MFG. DIVISION .. 5
Agency—J. Walter Thompson Co.

GENERAL ELECTRIC COMPANY 70, 71
Agency—G. M. Basford Company

GLOBE INDUSTRIES, INC. 96
Agency—Weber, Geiger & Kalat, Inc.

GOODRICH CO., THE B. F. 3
Agency—Batten, Barton, Durstine & Osborn, Inc.

GYROMECHANISMS, INC. 43
Agency—Gaynor & Company, Inc.

HARTWELL AVIATION SUPPLY CO. 31
Agency—The McCarty Company

HARVEY ALUMINUM DIV. OF HARVEY MACHINE CO., INC. ..... Third Cover
Agency—Hixson & Jorgensen, Inc.

HI-SHEAR RIVET TOOL COMPANY, THE 6

HOFFMAN LABORATORIES, INC. 89
Agency—Anderson-McConnell Adv. Agency

HUGHES RESEARCH & DEVELOPMENT LABORATORIES 94
Agency—Foote, Cone & Belding

INTERNATIONAL ELECTRONIC RESEARCH CORP. 57
Agency—Jaycraft Co.

KAISER ALUMINUM & CHEMICAL SALES, INC. 79, 80, 81
Agency—Young & Rubicam, Inc.

KAMAN AIRCRAFT CORP., THE 48
Agency—Charles Palm & Co.

KAYNAR COMPANY, THE KAYLOCK DIV. ..... Second Cover
Agency—J. H. Strauss & Co.

KEARFOTT COMPANY, INC. 72
Agency—E. M. Freystadt Assoc., Inc.

LOCKHEED AIRCRAFT CORP. 52
Agency—Hal Stebbins Adv.

MARLIN-ROCKWELL CORPORATION 56
Agency—Griffith & Rowland Advertising

MARMAN PRODUCTS COMPANY, INC. 10
Agency—West-Marquis, Inc.

MARCONI'S WIRELESS TELEGRAPH CO. LTD. 95
Agency—Lavelle & Rupert Curtis Ltd

MICROMATIC HONE CORP. 49
Agency—The Griswold-Eshleman Co.

MINNEAPOLIS-HONEYWELL REGULATOR CO. ..... Front Cover
Agency—Foote, Cone & Belding

NATIONAL WATER LIFT COMPANY 25
Agency—E. L. Erickson & Associates, Inc.

NOPCO CHEMICAL COMPANY (PLASTICS DIV.) .. 42
Agency—Lewin, Williams & Saylor, Inc.

NORTH AMERICAN AVIATION, INC. ... 50, 85, 96, 105
Agency—Batten, Barton, Durstine & Osborn, Inc.

PACIFIC DIV., BENDIX AVIATION CORP. 82
Agency—The Shaw Company Adv.

PITTSBURGH PLATE GLASS CO. (SAFETY GLASS) 60
Agency—Batten, Barton, Durstine & Osborn, Inc.

PRATT & WHITNEY AIRCRAFT DIV., UNITED AIRCRAFT CORP. 39
Agency—Lennen & Newell, Inc.

RED BANK DIV., BENDIX AVIATION CORP. 61
Agency—MacManus, John & Adams, Inc.

REMLER COMPANY LTD. 34
Agency—Albert A. Drennan Adv. Agency

REPUBLIC AVIATION CORP. 65
Agency—DeGarmo, Incorporated

ROEBLING'S SONS CORP., JOHN A. 4
Agency—Beatty & Oliver, Inc.

ROLLS-ROYCE LTD. 66
Agency—The Wesley Associates

SCINTILLA MAGNETO DIV., BENDIX AVIATION CORP. 22
Agency—MacManus, John & Adams, Inc.

SCOTT AVIATION CORP. 67
Agency—Melvin F. Hall Adv., Agency, Inc.

SEARCHLIGHT SECTION .. 97, 98, 99, 100, 101, 102, 103

SPERRY GYROSCOPE CO., DIV. THE SPERRY CORP. 50
Agency—Equity Adv. Agency

TECO, INC. 64
Agency—Jaycraft Co.

THERMO ELECTRIC CO., INC. 40
Agency—Fred Lange Assoc., Inc.

TRANSPORT EQUIPMENT COMPANY 64
Agency—Jaycraft Co.

TUBE METHODS, INC. 21
Agency—John Miller Adv. Agency

TWIN COACH CO., AIRCRAFT DIVISION 46
Agency—Palm & Patterson, Inc.

UNITED STATES RADIUM CORP. 50
Agency—Lethon Advertising

VACUUM METALS CORP. (DIV. CRUCIBLE STEEL) 69
Agency—G. M. Basford Company

VICKERS, INC. A DIV. OF THE SPERRY CORP. .. 20
Agency—Witte & Burden Adv.

WESTINGHOUSE ELECTRIC CORP. 62, 63
Agency—Fuller & Smith & Ross, Inc.

SEARCHLIGHT SECTION

(Classified Advertising)

H. E. Hilty, Mgr.

EMPLOYMENT
Positions Vacant 97–103
Positions Wanted 100
Employment Agencies 98

SPECIAL SERVICES
To the Industry 102

PLANES—EQUIPMENT
(Used or Surplus New)
For Sale 103

WANTED
Planes-Equipment 102

BOWERS BATTERIES

Always Better

BOWERS BATTERY & SPARK PLUG CO., READING, PA.

ENGINEERS

FOR DESIGN AND DEVELOPMENT OF COMPRESSORS TURBINES AND MAJOR ENGINE COMPONENTS

• • •

DESIGN ENGINEERS
STRESS ANALYSTS
DESIGN LAYOUT DRAFTSMEN
AERODYNAMICISTS

Here's opportunity for *you* as a part of Fairchild's expanding operations in the field of propulsion—including turbines, reciprocating engines, new-type powerplants and propellants. Whether you're well experienced or just getting your start in this field, we would like to talk with you. Won't you write or visit us and outline your complete background. Replies are kept in complete confidence, of course.

ENGINE AND AIRPLANE CORPORATION

FAIRCHILD

ENGINE DIVISION

New Highway
FARMINGDALE, L. I., NEW YORK
North on Exit 34 off Southern State Pkwy.

ENGINEERING OPPORTUNITIES IN LONG RANGE GUIDED MISSILE PROGRAM

MISSILE STRUCTURES ENGINEERS

Challenging problems in:—

Aeroelasticity & Flutter
Vibration
Loads
Structures Analysis
Weights

Openings at both junior and senior levels. For additional information forward resume to:

Missile & Control Equipment Dept. A.
Engineering Personnel

NORTH AMERICAN AVIATION, INC.
12214 Lakewood Blvd.
Downey, California

LETTERS

Lake Central Proposal

We received this morning a copy of your Dec. 6 issue of AVIATION WEEK and, on behalf of Lake Central, want to thank you very much for the fine things you said about our operation and the very fine background and buildup regarding the purchase of 97% of the stock by the employes of our company . . .

We found information of this type and material to be most helpful in presenting our story to members of Congress, as well as to the state legislatures in Indiana, Ohio and Michigan when acquainting them with Lake Central Airlines . . . This is the first big story and supporting editorial comment that has even been publicized on the stock acquisition program. Therefore, to us, it is of great interest and great importance.

Would it be possible for us to use the story and editorial in our house publication in toto, as well as excerpts? Also, will your publishers quote us a price on reprints? . . .

I speak for myself, as well as the 165 other Lake Central employes who have purchased the stock, in offering our thanks again to you and your staff for the very fine articles. If we can provide you with any future information or assistance, please do not hesitate to call on us.

JAMES W. E. HUMPHREY
General Sales Manager
Lake Central Airlines, Inc.
Weir Cook Airport
Indianapolis, Ind.

Avionic Sand Casting

I wish to take this opportunity of thanking you for the very wonderful article which you wrote in AVIATION WEEK Nov. 15, 1954 (p. 34). This article, in my opinion, covers completely the story of our new type of casting. From this article I have received many favorable comments from personnel within the Sperry organization, and we have received in this short period at least 50 inquiries from concerns all over the United States for reprints of this article and further information about our types of castings.

LEONARD MULLER, Foundry Manager
Sperry Gyroscope Co.
Great Neck, N. Y.

Flettner's Rotocraft

In your excellent report on Mr. Flettner's helicopter work in the Nov. 29 issue of AVIATION WEEK you included a remark on the McDonnell XV-1 convertiplane which, according to Mr. Flettner's and my opinion, appears to require some clarification.

Mr. Flettner suggested the addition of a fixed wing to a gear-driven helicopter about 10 years ago. At that time, when I was Mr. Flettner's consultant, I made a preliminary study of this problem which was later extended under sponsorship of the Office of Naval Research and presented at the 5th anual forum of the American Helicopter Society in 1949. According to this study, partial blade stall in highspeed helicopter flight with its energy loss and with its detrimental effects on vibration level and control can be avoided by adding to the helicopter a small fixed wing with an area of about 5% of the rotor disk area. The main feature of the rotor-wing combination in this study was the: *Constant rotor rpm.* throughout the flight range which is necessary in a gear-driven rotor unless multispeed transmissions are used.

The McDonnell XV-1 convertiplane is different in principle from the rotor-wing combination originally suggested by Mr. Flettner. The XV-1 has a pressure jet driven rotor which allows to reduce the rotor rpm. in autorotational flight to less than one-half the rotor rpm. in helicopter flight. At this low rpm. the rotor is almost completely "unloaded" and obviously unfit to provide any propulsive force which has to be gained from other means. After power transition from jet rotor drive to propeller drive the XV-1 flight condition is somewhat similar to that of the early winged Autogiros which flew more than 20 years ago and which had higher maximum speed than most of the later helicopters of comparable power loading.

To sum up: The XV-1 combines the features of the early winged Autogiros with the features of the pressure jet helicopter first developed by Doblhoff during the last world war in Austria and has no connection with Mr. Flettner's proposal to add a fixed wing to the gear-driven helicopter in order to obtain higher flight speed by avoiding partial blade stall.

K. H. HOHENEMSER
Chief of Aerodynamics
Helicopter Engineering Division
McDonnell Aircraft Corp.
St. Louis 3, Mo.

Of Fish and Birds

Your "Letters" column Dec. 13 carried a letter headlined "No Supersonic Fish," with an editor's comment quoting David Anderton that neither fish nor birds have matched man's ability to exceed the speed of sound. Somebody obviously is forgetting about Lockheed's Herman R. (Fish) Salmon, the well-known test pilot, who currently is assigned to the spectacular XF-104 and XFV-1 vertical takeoff fighter. As for supersonic birds, have you never heard of the Maching bird?

RICHARD L. BEAN
Publicity Manager
Lockheed Aircraft Corp.
Burbank, Calif.

Evidently men, especially some breeds of "aeronautical engineer," have become oversophisticated. They should never become so smart as to underevaluate nature. I'm afraid our supersonic skysharks would be pretty sick guppies indeed were they forced to operate with power loadings comparable to that of a sparrow. We can yet learn plenty from nature when it comes to efficiency and conservation of energy.

JOSEPH R. KIRK, Chief Engineer
National Machine & Tool Co.
Jackson, Mich.

Air Safety Studies

We were delighted to see the item in AVIATION WEEK Dec. 27 entitled "Aviation Safety Studies Available," on page 32, listing a group of reports which are available from the Flight Safety Foundation. This publicity should be of considerable help to our organization in indicating the type of information which we handle.

R. M. WOODHAM, Associate Director
Flight Safety Foundation
471 Park Ave.
New York 22, N. Y.

Distress Signal Radio

It was very interesting to note the letter published in the Dec. 20 issue of AVIATION WEEK by Robert C. Codman, Conol Sales Co., 646 Chestnut Street, Waban 68, Mass. As a matter of fact, such a device is now being developed by our company for the USAF.

At the moment, due to the classified nature of the project, no details can be released. If the Air Force grants you permission to publish certain details, we will be, of course, very pleased to cooperate.

At any rate we just wanted to advise that Mr. Codman's concern about the rescue service is well founded and is being worked upon.

JULIUS KENDALL, Vice President-Sales
Greer Hydraulics, Inc.
New York International Airport
Jamaica 30, N. Y.

(Mr. Codman suggested that transport planes carry as emergency equipment, a battery-powered radio that would automatically send out a distress signal following a crash to immediately indicate that a plane had gone down to aid searchers in pinpointing its location.—ED.)

Praise

Just a word of praise and congratulations for Gerry McAllister's story in the current issue based on our year-end report. He certainly picked all the meat out of it.

AVERY MCBEE, Director
Public Relations
Aircraft Industries Assn.
610 Shoreham Building
Washington 5, D. C.

Northrop Engineers

I was very pleased with the excellent job Dave Anderton did in his article on Northrop engineering organization. He obviously understands our philosophy and concepts that we have used in arriving at our organization, in creating our new designs, and in improving our old ones.

When I consider the short time that we had to spend with Dave, I think he did an excellent job of understanding our attitudes and then expressing them to the public.

WILLIAM F. BALLHAUS
Chief Engineer
Northrop Aircraft, Inc.
Hawthorne, Calif.

Lightweight rigidity of

Harvey aluminum extruded wing panels

chosen for Lockheed XFV-1

Progressive aircraft engineering, exemplified by Lockheed's sensational new vertical takeoff fighter plane, means producing for tomorrow's needs today. Progressive aluminum engineering made it possible for Harvey to extrude extra wide, integrally stiffened wing panels for this fighter plane of the future. In addition to their great strength, these extruded aluminum wing panels mean substantial savings in machining and fabricating costs. This example is typical of what can be done with the many advanced extrusion techniques and modern equipment available at Harvey. You'll find it pays to deal with Harvey, the world's largest independent producer of aluminum extrusions.

An independent producer of aluminum extrusions in all alloys and all sizes: special extrusions, press forgings, hollow sections, structurals, rod and bar, forging stock, pipe, tubes, impact extrusions, aluminum screw machine products and rolled-ad products. Also alloy steel and titanium of similar products on application.

MAKING THE MOST OF ALUMINUM . . . FOR EVERYONE

HARVEY Aluminum

HARVEY ALUMINUM SALES, INC.
TORRANCE—LOS ANGELES, CALIFORNIA
BRANCH OFFICES IN PRINCIPAL CITIES

New Turbine-Powered Cargo Carrier

hauls big pay loads faster

Allison T56 Turbo-Prop Engines Power New Lockheed YC-130 Transport

The initial flight of the YC-130 Medium Cargo Transport marks another great forward stride in transport aviation.

This giant carrier, built by Lockheed for the U. S. Air Force, is the first U. S. A. F. cargo plane designed from the very beginning for Turbo-Prop engines.

Powered by four of the new Allison T56 Turbo-Prop engines, this great new cargo airplane can haul heavy pay loads long distances at speeds required by our new modern combat jet Air Force. It is ideally suited to carry many types of heavy military equipment, on either long-range operations or in close support of troops. It also can be fitted as a combat troop carrier or an ambulance plane. The YC-130 can operate from shorter runways with greater rate of climb than either reciprocating or Turbo-Jet engine aircraft.

All this, plus its economical use of lower cost fuel, label the Turbo-Prop engine as the "work horse" power for future transports. And Allison, with its unmatched experience in high-powered Turbo-Prop design and manufacture, today offers both T56 and T40 engines to serve a broad range of modern flight requirements.

GM GENERAL MOTORS *Allison* Division of General Motors, Indianapolis, Indiana